Michigan Department of Transportation
Traffic and Safety

GEOMETRIC DESIGN GUIDES

GEO - 100 THRU GEO - 690

ENGLISH VERSION

MDOT
Michigan Department of Transportation

DEPARTMENT DIRECTOR
KIRK T. STEUDLE

PREPARED BY
TRAFFIC AND SAFETY

ENGINEER OF TRAFFIC AND SAFETY

DRAWN BY: MTS

CHECKED BY: JAT

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GEOMETRIC DESIGN GUIDES INDEX

Guide Number and Name		Approval Date
GEO-100-F	One-Lane Tapered Entrance	09-06-07
GEO-101-F	One-Lane Parallel Entrance	09-06-07
GEO-110-C	Two-Lane Entrance	09-06-07
GEO-120-C	Successive Entrance	09-06-07
GEO-130-D	One-Lane Tapered Exit Ramp	08-07-08
GEO-131-D	One-Lane Parallel Exit Ramp	08-07-08
GEO-140-B	Two-Lane Exit Ramp	08-07-08
GEO-150-C	Successive Exit Ramps	08-07-08
GEO-202-B	12' Width Entrance and Exit Slip Ramps	08-07-08
GEO-300-D	Diamond Interchange	06-03-10
GEO-310-C	Collector-Distributor Road	06-03-10
GEO-320-C	Parclo - A - 4 - Quad	08-07-08
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GEO-340-A	Parclo - A - B - 2 - Quad	09-06-07
GEO-350-B	Trumpet Type	09-06-07
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GEO-370-D	Ramp Terminal Details	06-03-10
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GEO-500-C	Rest Area	08-07-08
GEO-610-C	Two-to-Four Lane Divided Transition	06-03-10
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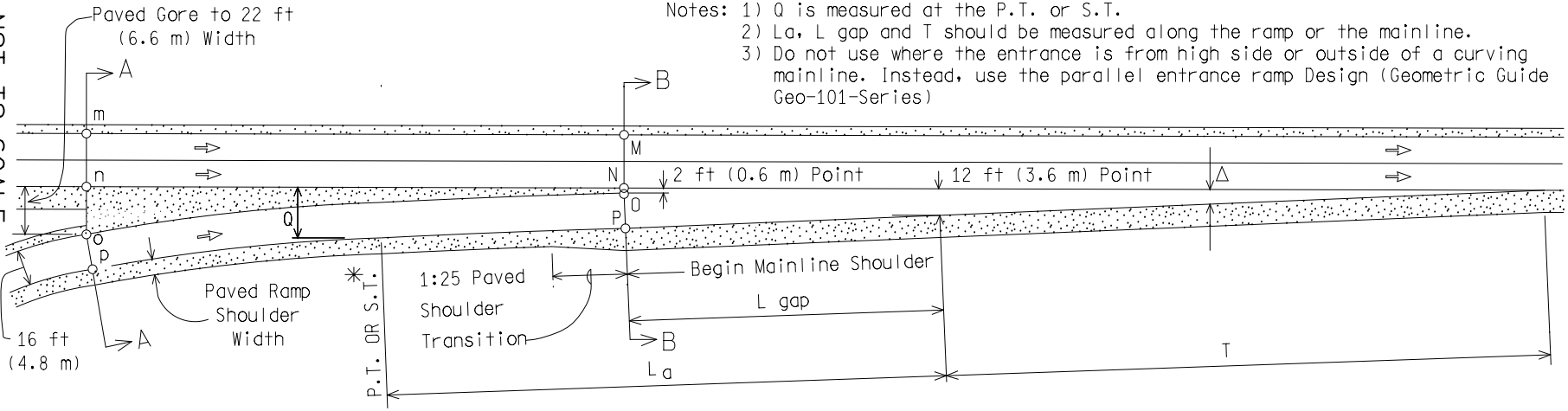
GEO-650-D	Flares and Intersection Details	06-03-10
GEO-670-D	Crossovers	06-03-10
GEO-680-B	Commercial Driveways	06-03-10
GEO-690-D	Temporary Runaround	06-03-10

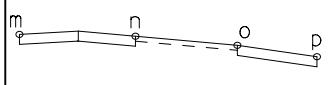
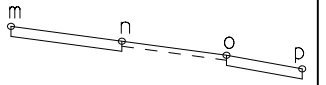
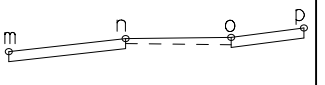
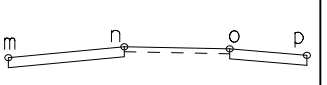
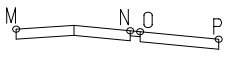
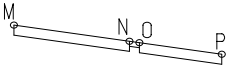
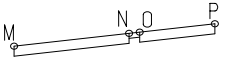
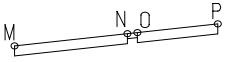
NOT TO SCALE



Notes: 1) Q is measured at the P.T. or S.T.
2) La, L gap and T should be measured along the ramp or the mainline.
3) Do not use where the entrance is from high side or outside of a curving mainline. Instead, use the parallel entrance ramp Design (Geometric Guide Geo-101-Series)

* When a transition spiral is used, reduce the distance between the S.T. and the 2 foot point by half of the transition spiral length. Recalculate "Q"

EDGE OF PAVEMENT ELEVATION RELATIONSHIPS

WHEN THE THROUGH LANES ARE NOT SUPERELEVATED	WHEN THE THROUGH LANES ARE SUPERELEVATED AND N IS LOWER THAN M	WHEN THE THROUGH LANES ARE SUPERELEVATED AND N IS HIGHER THAN M	
		RAMP AND THROUGH LANE SUPERELEVATED IN SAME DIRECTION	RAMP AND THROUGH LANE SUPERELEVATED IN OPPOSITE DIRECTION
SECTION A-A			
			
POINTS n, o & p SHOULD BE PROGRESSIVELY LOWER.	POINTS m, n, o & p SHOULD BE PROGRESSIVELY LOWER.	POINT o SHOULD BE HIGHER THAN POINT n.	POINT o SHOULD BE EQUAL TO OR LOWER THAN POINT n.
SECTION B-B			
			
POINTS N, O & P SHOULD BE IN THE SAME PLANE.	POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.

Note:
Maximum algebraic difference in pavement cross slope between mainline and ramp auxiliary lane should not exceed 5%.

MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

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REV. 05/24/2011 jt

GEOMETRIC DESIGN GUIDE FOR
ONE LANE TAPERED
ENTRANCE RAMP

PLAN DATE: 09/06/2007

GEO-100-F

SHEET 1 OF 4

MINIMUM ENGLISH LENGTHS FOR TAPERED ENTRANCE RAMPS

RAMP DESIGN SPEED (MPH)	PERCENT GRADE OF THROUGH ROADWAY	TAPER=65:1 Δ=0°52′53″ ROADWAY DESIGN SPEED = 75 MPH T = 780 FT Lgap = 390 FT		TAPER=60:1 Δ=0°57′17″ ROADWAY DESIGN SPEED = 70 MPH T = 720 FT Lgap = 360 FT		TAPER=55:1 Δ=1°02′30″ ROADWAY DESIGN SPEED = 60 MPH T = 660 FT Lgap = 330 FT		TAPER=50:1 Δ=1°08′45″ ROADWAY DESIGN SPEED = 55 to 50 MPH T = 600 FT Lgap = 300 FT		TAPER=45:1 Δ=1°16′23″ ROADWAY DESIGN SPEED = 45 or less MPH T = 540 FT Lgap = 270 FT	
		La (FT)	Q (FT)	La (FT)	Q (FT)	La (FT)	Q (FT)	La (FT)	Q (FT)	La (FT)	Q (FT)
20	-3 TO LESS THAN -5	978	27.1	912	27.2	660	24.0	506	22.2	450	22.0
	BETWEEN -3 AND +3	1630	37.1	1520	37.4	1100	32.0	810	28.2	450	22.0
	+3 TO LESS THAN +5	2528	50.9	2280	50.0	1540	40.0	1094	33.9	608	25.5
25	-3 TO LESS THAN -5	948	26.6	852	26.2	612	23.2	500	22.0	450	22.0
	BETWEEN -3 AND +3	1580	36.4	1420	35.7	1020	30.6	780	27.6	450	22.0
	+3 TO LESS THAN +5	2528	50.9	2201	48.7	1479	38.9	1092	33.9	608	25.5
30	-3 TO LESS THAN -5	906	26.0	810	25.5	555	22.0	500	22.0	450	22.0
	BETWEEN -3 AND +3	1510	35.3	1350	34.5	910	28.6	670	25.4	450	22.0
	+3 TO LESS THAN +5	2492	50.4	2160	48.0	1365	36.9	972	31.5	608	25.5
35	-3 TO LESS THAN -5	852	25.2	738	24.3	550	22.0	500	22.0	450	22.0
	BETWEEN -3 AND +3	1420	33.9	1230	32.5	800	26.6	550	23.0	450	22.0
	+3 TO LESS THAN +5	2450	49.7	2030	45.9	1200	33.9	798	28.0	608	25.5
40	-3 TO LESS THAN -5	696	22.8	600	22.0	550	22.0	500	22.0	450	22.0
	BETWEEN -3 AND +3	1160	29.9	1000	28.7	550	22.0	500	22.0	450	22.0
	+3 TO LESS THAN +5	2088	44.2	1700	40.4	825	27.0	725	26.5	608	25.5
45	-3 TO LESS THAN -5	650	22.0	600	22.0	550	22.0	500	22.0	450	22.0
	BETWEEN -3 AND +3	1040	28.0	820	25.7	550	22.0	500	22.0	450	22.0
	+3 TO LESS THAN +5	1924	41.6	1435	36.0	825	27.0	725	26.5	608	25.5
50	-3 TO LESS THAN -5	650	22.0	600	22.0	550	22.0	500	22.0		
	BETWEEN -3 AND +3	780	24.0	600	22.0	550	22.0	500	22.0		
	+3 TO LESS THAN +5	1482	34.8	1080	30.0	825	27.0	725	26.5		
55	-3 TO LESS THAN -5	650	22.0	600	22.0	550	22.0	500	22.0		
	BETWEEN -3 AND +3	650	22.0	600	22.0	550	22.0	500	22.0		
	+3 TO LESS THAN +5	1268	31.5	1080	30.0	825	27.0	725	26.5		
60	-3 TO LESS THAN -5	650	22.0	600	22.0	550	22.0				
	BETWEEN -3 AND +3	650	22.0	600	22.0	550	22.0				
	+3 TO LESS THAN +5	1268	31.5	1080	30.0	825	27.0				
65	-3 TO LESS THAN -5	650	22.0	600	22.0						
	BETWEEN -3 AND +3	650	22.0	600	22.0						
	+3 TO LESS THAN +5	1268	31.5	1080	30.0						
70	-3 TO LESS THAN -5	650	22.0	600	22.0						
	BETWEEN -3 AND +3	650	22.0	600	22.0						
	+3 TO LESS THAN +5	1268	31.5	1080	30.0						
75	-3 TO LESS THAN -5	650	22.0								
	BETWEEN -3 AND +3	650	22.0								
	+3 TO LESS THAN +5	1268	31.5								

NOT TO SCALE

MINIMUM METRIC LENGTHS FOR TAPERED ENTRANCE RAMPS

RAMP DESIGN SPEED (km/hr)	PERCENT GRADE OF THROUGH ROADWAY	TAPER=65:1 Δ=0°52′53″ ROADWAY DESIGN SPEED = 120 Km/Hr T = 238 m Lgap = 119 m		TAPER=60:1 Δ=0°57′17″ ROADWAY DESIGN SPEED = 110 Km/Hr T = 219 m Lgap = 110 m		TAPER=55:1 Δ=1°02′30″ ROADWAY DESIGN SPEED = 100 Km/Hr T = 201 m Lgap = 101 m		TAPER=50:1 Δ=1°08′45″ ROADWAY DESIGN SPEED = 90 to 80 Km/Hr T = 183 m Lgap = 91 m		TAPER=45:1 Δ=1°16′23″ ROADWAY DESIGN SPEED = 70 Km/Hr or less T = 165 m Lgap = 82 m	
		L_a (m)	Q (m)	L_a (m)	Q (m)	L_a (m)	Q (m)	L_a (m)	Q (m)	L_a (m)	Q (m)
30	-3 TO LESS THAN -5	309	8.4	234	7.5	183	7.0	152	6.7	137	6.7
	BETWEEN -3 AND +3	515	11.6	390	10.1	305	9.2	225	8.1	137	6.7
	+3 TO LESS THAN +5	736	14.7	555	12.7	428	11.4	315	9.9	178	7.6
40	-3 TO LESS THAN -5	294	8.2	222	7.3	171	6.8	152	6.7	137	6.7
	BETWEEN -3 AND +3	490	11.2	370	9.8	285	8.8	205	7.7	137	6.7
	+3 TO LESS THAN +5	736	15.0	555	12.9	428	11.4	287	9.4	178	7.6
50	-3 TO LESS THAN -5	276	7.9	204	7.0	168	6.7	152	6.7	137	6.7
	BETWEEN -3 AND +3	460	10.7	340	9.3	255	8.3	175	7.1	137	6.7
	+3 TO LESS THAN +5	736	15.0	544	12.7	408	11.1	263	8.9	178	7.6
60	-3 TO LESS THAN -5	246	7.4	183	6.7	168	6.7	152	6.7	137	6.7
	BETWEEN -3 AND +3	410	10.0	290	8.5	205	7.4	152	6.7	137	6.7
	+3 TO LESS THAN +5	697	14.4	493	11.9	349	10.0	243	8.5	178	7.6
70	-3 TO LESS THAN -5	198	6.7	183	6.7	168	6.7	152	6.7	137	6.7
	BETWEEN -3 AND +3	325	8.6	200	7.0	168	6.7	152	6.7	137	6.7
	+3 TO LESS THAN +5	553	12.1	340	9.3	302	9.1	243	8.5	178	7.6
80	-3 TO LESS THAN -5	198	6.7	183	6.7	168	6.7	152	6.7	137	6.7
	BETWEEN -3 AND +3	245	7.4	183	6.7	168	6.7	152	6.7	137	6.7
	+3 TO LESS THAN +5	441	10.4	329	9.1	302	9.1	243	8.5	178	7.6
90	-3 TO LESS THAN -5	198	6.7	183	6.7	168	6.7	152	6.7		
	BETWEEN -3 AND +3	198	6.7	183	6.7	168	6.7	152	6.7		
	+3 TO LESS THAN +5	356	9.1	329	9.1	302	9.1	243	8.5		
100	-3 TO LESS THAN -5	198	6.7	183	6.7	168	6.7				
	BETWEEN -3 AND +3	198	6.7	183	6.7	168	6.7				
	+3 TO LESS THAN +5	356	9.1	329	9.1	302	9.1				
110	-3 TO LESS THAN -5	198	6.7	183	6.7						
	BETWEEN -3 AND +3	198	6.7	183	6.7						
	+3 TO LESS THAN +5	356	9.1	329	9.1						
120	-3 TO LESS THAN -5	198	6.7								
	BETWEEN -3 AND +3	198	6.7								
	+3 TO LESS THAN +5	356	9.1								

NOT TO SCALE

NOTES:

1. The designer has the flexibility to choose either the taper type ramp or the parallel type ramp. However, the same type of entrance and exit ramp should be used within an interchange and corridor. Uniformity in design is needed to aid driver expectancy. On sharp curves, it may be preferable to use parallel type ramps.

2. Select design speed based on a combination of the superelevation rate and the radius of the curve. See also chapter 3 of the MDOT Road Design Manual.

3. If an additional through lane is provided or the entrance ramp joins the mainline on the high side (outside) of the curve, use GEO-101-Series.

4. If the through pavement is curved, plot offsets for taper and connect with appropriate curve.

5. Prepare detail grades and profiles from Section A-A to section B-B.

6. The value of La or Lgap, whichever produces the greater distance downstream from the 2 ft (0.6 m) point, is suggested for use in the design of the ramp entrance. La is the acceleration distance. Lgap is the minimum distance required to find a gap in traffic and merge onto the mainline.

7. Spirals transitions should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. The table gives the maximum radius in which a spiral should be used.

8. The maximum algebraic difference in pavement cross slope between the mainline and the ramp auxiliary lane should not exceed 5%.

9. The cross slope in the gore area between the 2 ft (0.6 m) point and the 22 ft (6.6 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope between the gore and the adjacent paved lane. This algrebraic difference also applies within crowned gores.

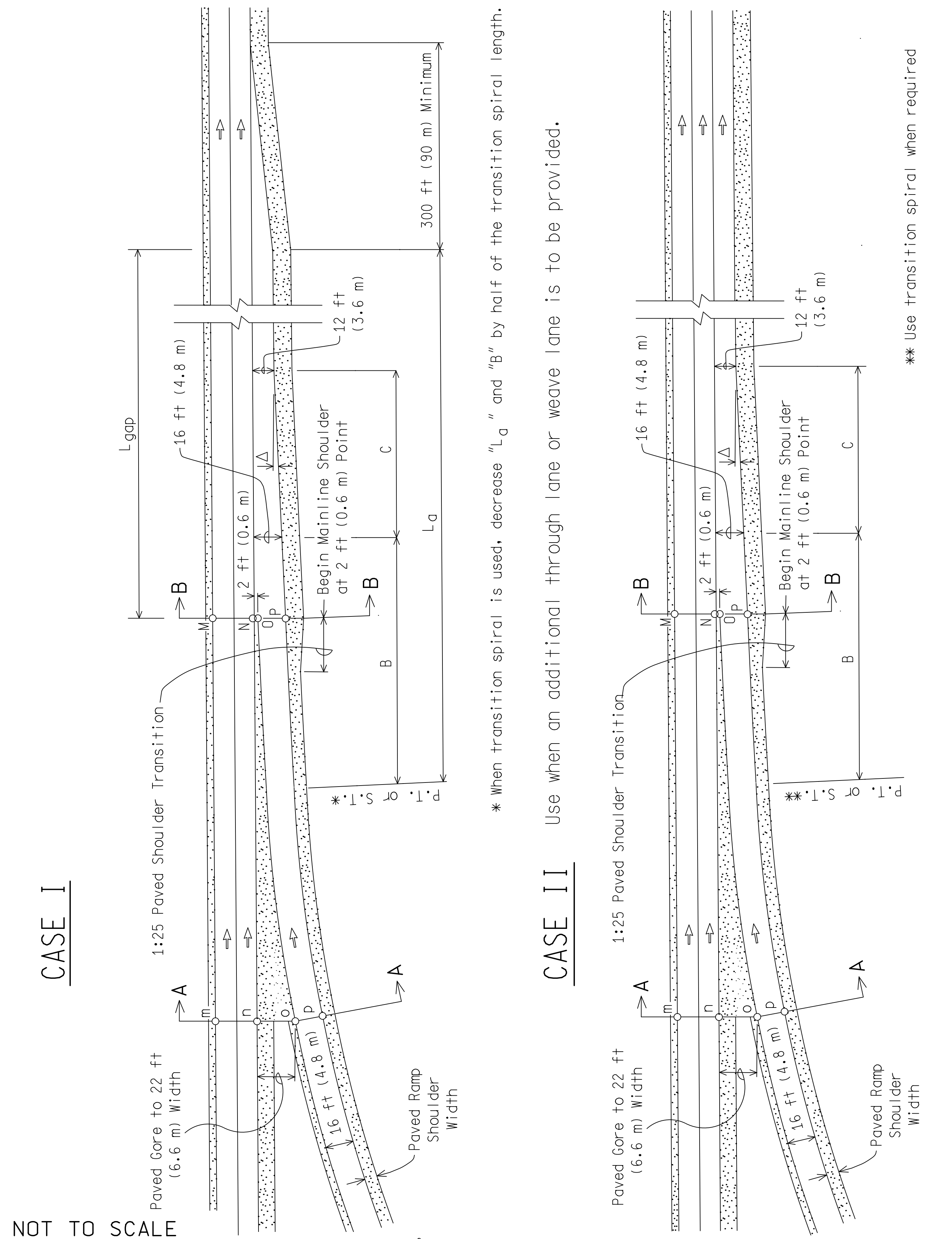
10. The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

11. The mainline shoulder width should extend along the ramp to where the gore is 2 ft (0.6 m) wide. Use a 1:25 taper transition where it joins the ramp shoulder paving.

12. Each ramp should be carefully studied to provide maximum vision at its merge points. See Geometric Design Guide GEO-300-Series.

13. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE



NOT TO SCALE

MDOT
Michigan Department of Transportation
TRAFFIC AND SAFETY

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CHECKED BY: IRG/JAT
FILE:PW/RD/TS/Geom D/mdot GEO101E EOC.dgn

BY: John C. Friend
ENGINEER OF DELIVERY

BY: [signature]
ENGINEER OF DEVELOPMENT

REV. 07-19-11 AR

GEOMETRIC DESIGN GUIDE FOR

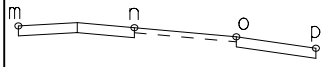
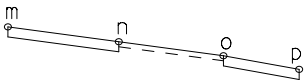
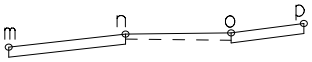
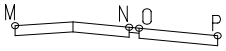
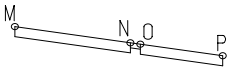
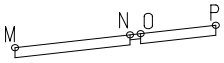
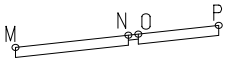
ONE-LANE PARALLEL ENTRANCE RAMP

09/06/2007
PLAN DATE:

GEO-101-F

SHEET 1 OF 5

EDGE OF PAVEMENT ELEVATION RELATIONSHIPS

WHEN THE THROUGH LANES ARE NOT SUPERELEVATED	WHEN THE THROUGH LANES ARE SUPERELEVATED AND N IS LOWER THAN M	WHEN THE THROUGH LANES ARE SUPERELEVATED AND N IS HIGHER THAN M	
		RAMP AND THROUGH LANE SUPERELEVATED IN SAME DIRECTION	RAMP AND THROUGH LANE SUPERELEVATED IN OPPOSITE DIRECTION
SECTION A-A			
 POINTS n, o & p SHOULD BE PROGRESSIVELY LOWER.	 POINTS m, n, o & p SHOULD BE PROGRESSIVELY LOWER.	 POINT o SHOULD BE HIGHER THAN POINT n.	 POINT o SHOULD BE EQUAL TO OR LOWER THAN POINT n.
SECTION B-B			
 POINTS N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.

Note: Maximum algebraic difference in pavement cross slope between mainline and ramp auxiliary lane should not exceed 5%.

NOT TO SCALE

MINIMUM ENGLISH LENGTHS FOR PARALLEL ENTRANCE RAMPS

RAMP DESIGN SPEED (MPH)	PERCENT GRADE OF THROUGH ROADWAY	TAPER=65:1 Δ=0°52′53″ ROADWAY DESIGN SPEED = 75 MPH B = 390 FT C = 260 FT Lgap = 390 FT La (FT)	TAPER=60:1 Δ=0°57′17″ ROADWAY DESIGN SPEED = 70 MPH B = 360 FT C = 240 FT Lgap = 360 FT La (FT)	TAPER=55:1 Δ=1°02′30″ ROADWAY DESIGN SPEED = 60 MPH B = 330 FT C = 220 FT Lgap = 330 FT La (FT)	TAPER=50:1 Δ=1°08′45″ ROADWAY DESIGN SPEED = 55 to 50 MPH B = 300 FT C = 200 FT Lgap = 300 FT La (FT)	TAPER=45:1 Δ=1°16′23″ ROADWAY DESIGN SPEED = 45 or less MPH B = 270 FT C = 180 FT Lgap = 270 FT La (FT)
20	-3 TO LESS THAN -5	978	912	660	506	450
	BETWEEN -3 AND +3	1630	1520	1100	810	450
	+3 TO LESS THAN +5	2528	2280	1540	1094	608
25	-3 TO LESS THAN -5	948	852	612	500	450
	BETWEEN -3 AND +3	1580	1420	1020	780	450
	+3 TO LESS THAN +5	2528	2201	1479	1092	608
30	-3 TO LESS THAN -5	906	810	550	500	450
	BETWEEN -3 AND +3	1510	1350	910	670	450
	+3 TO LESS THAN +5	2492	2160	1365	972	608
35	-3 TO LESS THAN -5	852	738	550	500	450
	BETWEEN -3 AND +3	1420	1230	800	550	450
	+3 TO LESS THAN +5	2450	2030	1200	798	608
40	-3 TO LESS THAN -5	696	600	550	500	450
	BETWEEN -3 AND +3	1160	1000	550	500	450
	+3 TO LESS THAN +5	2088	1700	825	725	608
45	-3 TO LESS THAN -5	650	600	550	500	450
	BETWEEN -3 AND +3	1040	820	550	500	450
	+3 TO LESS THAN +5	1924	1435	825	725	608
50	-3 TO LESS THAN -5	650	600	550	500	
	BETWEEN -3 AND +3	780	600	550	500	
	+3 TO LESS THAN +5	1482	1080	825	725	
55	-3 TO LESS THAN -5	650	600	550	500	
	BETWEEN -3 AND +3	650	600	550	500	
	+3 TO LESS THAN +5	1268	1080	825	725	
60	-3 TO LESS THAN -5	650	600	550		
	BETWEEN -3 AND +3	650	600	550		
	+3 TO LESS THAN +5	1268	1080	825		
65	-3 TO LESS THAN -5	650	600			
	BETWEEN -3 AND +3	650	600			
	+3 TO LESS THAN +5	1268	1080			
70	-3 TO LESS THAN -5	650	600			
	BETWEEN -3 AND +3	650	600			
	+3 TO LESS THAN +5	1268	1080			
75	-3 TO LESS THAN -5	650				
	BETWEEN -3 AND +3	650				
	+3 TO LESS THAN +5	1268				

NOT TO SCALE

MINIMUM METRIC LENGTHS FOR PARALLEL ENTRANCE RAMPS

RAMP DESIGN SPEED (km/hr)	PERCENT GRADE OF THROUGH ROADWAY	TAPER=65:1 Δ=0°52′53″ ROADWAY DESIGN SPEED = 120 Km/Hr B = 119 m C = 79 m Lgap = 119 m	TAPER=60:1 Δ=0°57′17″ ROADWAY DESIGN SPEED = 110 Km/Hr B = 110 m C = 73 m Lgap = 110 m	TAPER=55:1 Δ=1°02′30″ ROADWAY DESIGN SPEED = 100 Km/Hr B = 101 m C = 67 m Lgap = 101 m	TAPER=50:1 Δ=1°08′45″ ROADWAY DESIGN SPEED = 90 TO 80 Km/Hr B = 91 m C = 61 m Lgap = 91 m	TAPER=45:1 Δ=1°16′23″ ROADWAY DESIGN SPEED = 70 Km/Hr or Less B = 82 m C = 55 m Lgap = 82 m
		L_a (m)	L_a (m)	L_a (m)	L_a (m)	L_a (m)
30	-3 TO LESS THAN -5	309	234	183	152	137
	BETWEEN -3 AND +3	515	390	305	225	137
	+3 TO LESS THAN +5	736	555	428	315	178
40	-3 TO LESS THAN -5	294	222	171	152	137
	BETWEEN -3 AND +3	490	370	285	205	137
	+3 TO LESS THAN +5	736	555	428	287	178
50	-3 TO LESS THAN -5	276	204	168	152	137
	BETWEEN -3 AND +3	460	340	255	175	137
	+3 TO LESS THAN +5	736	544	408	263	178
60	-3 TO LESS THAN -5	246	183	168	152	137
	BETWEEN -3 AND +3	410	290	205	152	137
	+3 TO LESS THAN +5	697	493	349	243	178
70	-3 TO LESS THAN -5	198	183	168	152	137
	BETWEEN -3 AND +3	325	200	168	152	137
	+3 TO LESS THAN +5	553	340	268	243	178
80	-3 TO LESS THAN -5	198	183	168	152	137
	BETWEEN -3 AND +3	245	183	168	152	137
	+3 TO LESS THAN +5	441	329	302	243	178
90	-3 TO LESS THAN -5	198	183	168	152	
	BETWEEN -3 AND +3	198	183	168	152	
	+3 TO LESS THAN +5	356	329	302	243	
100	-3 TO LESS THAN -5	198	183	168		
	BETWEEN -3 AND +3	198	183	168		
	+3 TO LESS THAN +5	356	329	302		
110	-3 TO LESS THAN -5	198	183			
	BETWEEN -3 AND +3	198	183			
	+3 TO LESS THAN +5	356	329			
120	-3 TO LESS THAN -5	198				
	BETWEEN -3 AND +3	198				
	+3 TO LESS THAN +5	356				

NOT TO SCALE

NOTES:

1. The designer has the flexibility to choose either the taper type ramp or the parallel type ramp. However, the same type of entrance and exit ramp should be used within an interchange and corridor. Uniformity in design is needed to aid driver expectancy. On sharp curves, it may be preferable to use parallel type ramps.

2. Select design speed based on a combination of the superelevation rate and the radius of the curve. See also chapter 3 of the MDOT Road Design Manual.

3. If the through pavement is curved, plot offsets for the taper and connect with the appropriate curve.

4. Prepare detail grades and profiles from Section A-A to Section B-B.

5. The value of La or Lgap, whichever produces the greater distance downstream from the 2 ft (0.6 m) point, is suggested for use in the design of the ramp entrance. La is the acceleration distance. Lgap is the minimum distance required to find a gap in traffic and merge onto the mainline.

6. Spiral transitions should be used on new ramp alignments, based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. The table gives the maximum radius in which a spiral should be used.

7. The maximum algebraic difference in pavement cross slope between the mainline and the ramp auxiliary lane should not exceed 5%.

8. The cross slope in the gore area between the 2 ft (0.6 m) point and the 22 ft (6.6 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope between the gore and the adjacent lane. This algebraic difference also applies within crowned gores.

9. The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

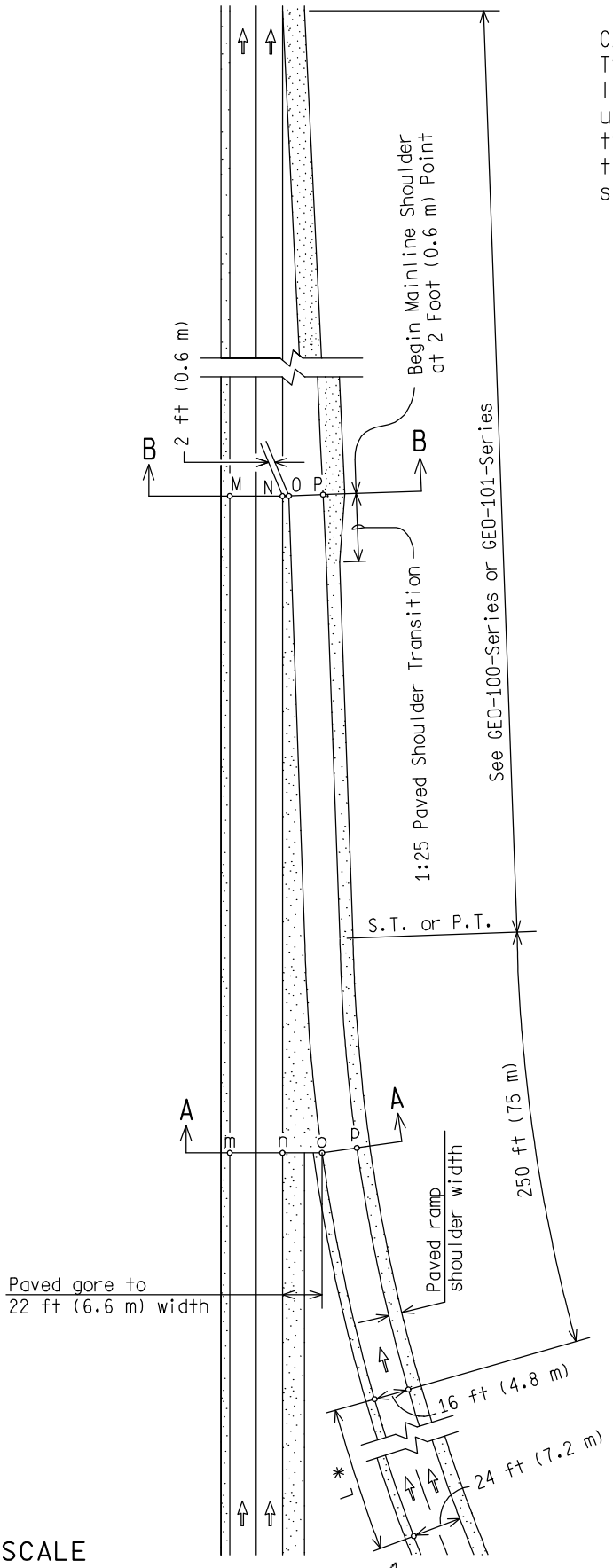
10. The mainline shoulder width should extend along the ramp to where the gore is 2 ft (0.6 m) wide. Use a 1:25 taper transition where it joins the ramp shoulder paving.

11. Each ramp should be carefully studied to provide maximum vision at its merge points. See Geometric Design Guide GEO-300-Series.

12. These design concepts are for new construction. Where modifications may be needed for retrofitting to existing road features, consult with the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE

CASE I



CASE I:
Two ramp lanes merge to one lane on ramp proper. Consider use on two lane ramps when a two lane merge is not required to obtain a desired level of service.

Calculation for Transition Length "L" (V = Design Speed)
English (L in Ft and V in MPH):
L ft = (12)(V MPH) for V ≥ 45 MPH
$L = \frac{V^2}{5}$ for V ≤ 40 MPH
Metric (L in m and V in km/hr):
L = (2.25)(V) for V ≥ 70 km/hr
$L = \frac{V^2}{43}$ for V ≤ 65 km/hr
* Note: Transition to one lane should be consistently on the left or the right within the interchange, if feasible.

NOT TO SCALE

MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

DRAWN BY: LPS/ECH
CHECKED BY: JAT/IRG

BY: John C. Friend
ENGINEER OF DELIVERY

BY:
ENGINEER OF DEVELOPMENT

FILE: PW/RD/TS/Geom D/mdot GEO110C EOC.dgn REV. 09/06/2007

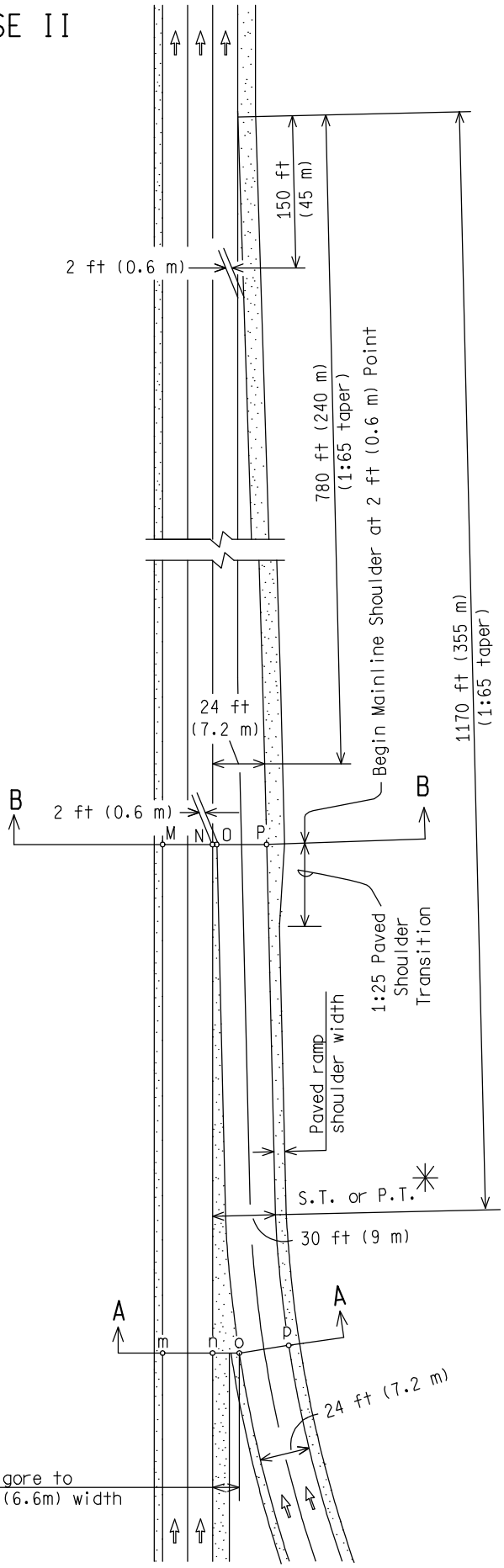
GEOMETRIC DESIGN GUIDE FOR
TWO LANE ENTRANCE RAMP

09/06/2007
PLAN DATE:

GEO-110-C

SHEET 1 OF 6

CASE II



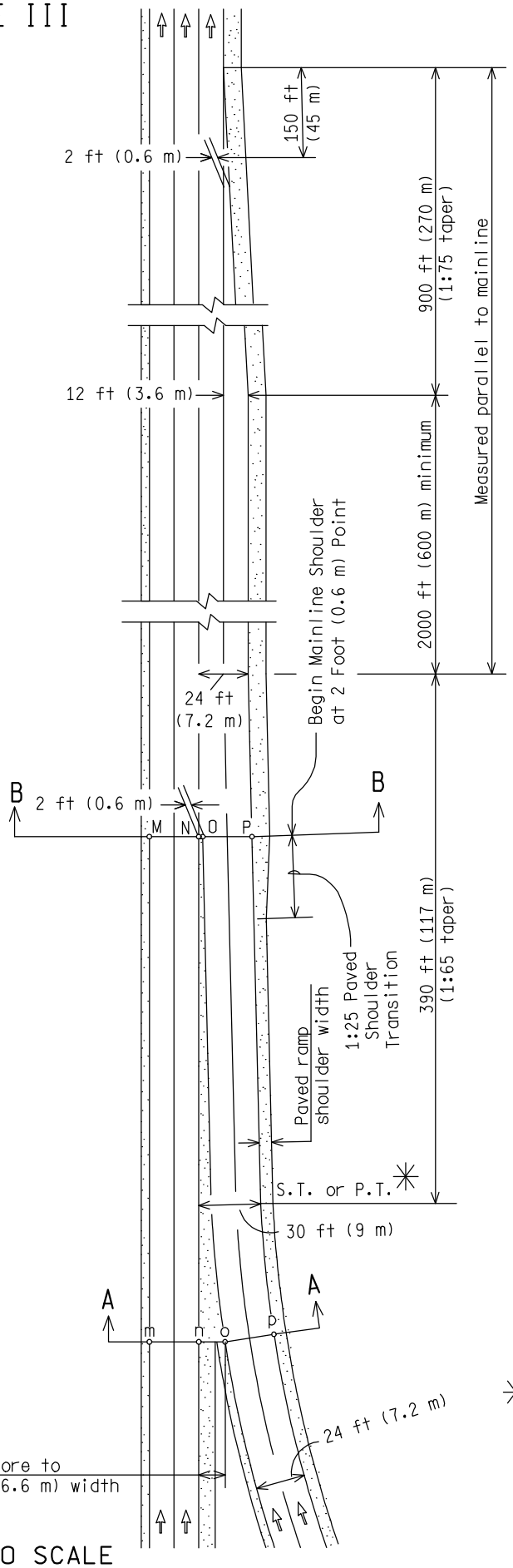
CASE II:
Outside ramp lane is tapered away. Inside ramp lane is added, consider use on 2 lane ramps to achieve a desired level of service. If an additional lane drop is required, the added lane may be dropped after 0.5 mile (800 meters).

Mainline Design Speed = 75 MPH (120 Km/hr)

✳ When transition spiral is used, reduce the 1170 feet (355 meters) by half of the transition spiral length. The 30 foot (9 meter) lateral offset distance should be recalculated.

NOT TO SCALE

CASE III



CASE III:
Outside ramp lane is dropped after a parallel section. Inside ramp lane is added. Consider use on two lane ramps when the desired level of service is not met by Case II. If an additional lane drop is required, the added lane may be dropped after 0.5 miles (800 meters).

Mainline Design Speed = 75 MPH (120 Km/hr)

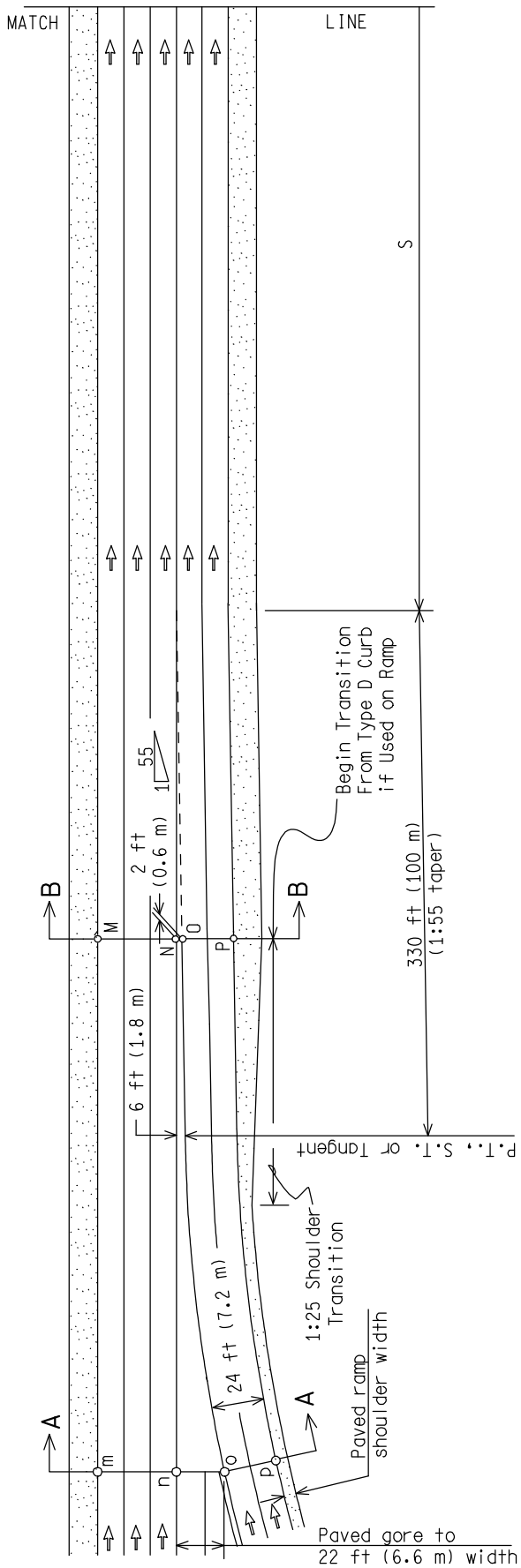
✳ When transition spiral is used, reduce the 390 feet (117 meters) by half of the transition spiral length. The 30 foot (9 meter) lateral offset distance should be recalculated.

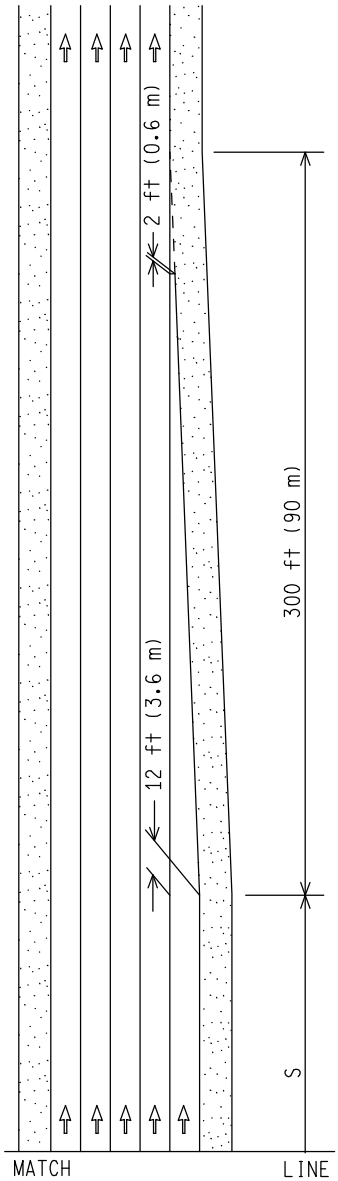
NOT TO SCALE

CASE IV

CASE IV:
Two lane entrance with freeway lanes increased by one after gore. Outside ramp lane is dropped after a parallel section. Ramp lane is added.

Mainline
Design speed = 60 mph (100 km/hr).

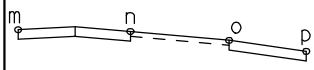
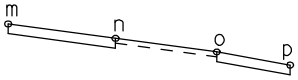
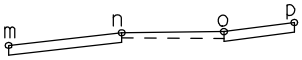
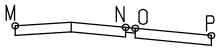
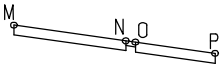
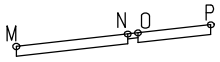
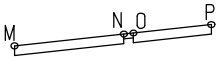




Mainline 60 MPH (100 km/hr) Freeway Design Speed	
Percent Grade of Through Roadway	S in Feet (Meters)
-3 to less than -5	380 (115)
Between -3 and +3	680 (185)
+3 to less than +5	1080 (340)

NOT TO SCALE

EDGE OF PAVEMENT ELEVATION RELATIONSHIPS

WHEN THE THRU LANES ARE NOT SUPERELEVATED	WHEN THE THRU LANES ARE SUPERELEVATED AND N IS LOWER THAN M	WHEN THE THRU LANES ARE SUPERELEVATED AND N IS HIGHER THAN M	
		RAMP AND THRU LANE SUPERELEVATED IN SAME DIRECTION	RAMP AND THRU LANE SUPERELEVATED IN OPPOSITE DIRECTION
SECTION A-A			
 POINTS n, o & p SHOULD BE PROGRESSIVELY LOWER.	 POINTS m, n, o & p SHOULD BE PROGRESSIVELY LOWER.	 POINT o SHOULD BE HIGHER THAN POINT n.	 POINT o SHOULD BE EQUAL TO OR LOWER THAN POINT n.
SECTION B-B			
 POINTS N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.

NOTE: Maximum algebraic difference in pavement cross slope between mainline and ramp auxiliary lane should not exceed 5%.

NOT TO SCALE

NOTES:

1. Select design speed based on combination of the superelevation rate and the radius of the curve. See chapter 3 of the MDOT Road Design Manual.

2. If the through pavement is curved, plot offsets for the taper and connect with the appropriate curve.

3. Prepare detail grades and profiles from Section A-A to Section B-B to assure proper drainage.

4. Spiral transitions should be used on new ramp alignments, based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. The table gives maximum radius in which a spiral should be used.

5. The maximum algebraic difference in pavement cross slope between the mainline and the ramp auxiliary lane should not exceed 5%.

6. The cross slope in the gore area between the 2 ft (0.6 m) point and the 22 ft (6.6 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope between the gore and the adjacent lane. This algebraic difference also applies within crowned gores.

7. The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

8. The mainline shoulder width should extend along the ramp to where the gore is 2 ft (0.6 m) wide. Use a 1:25 taper transition where it joins the ramp shoulder paving.

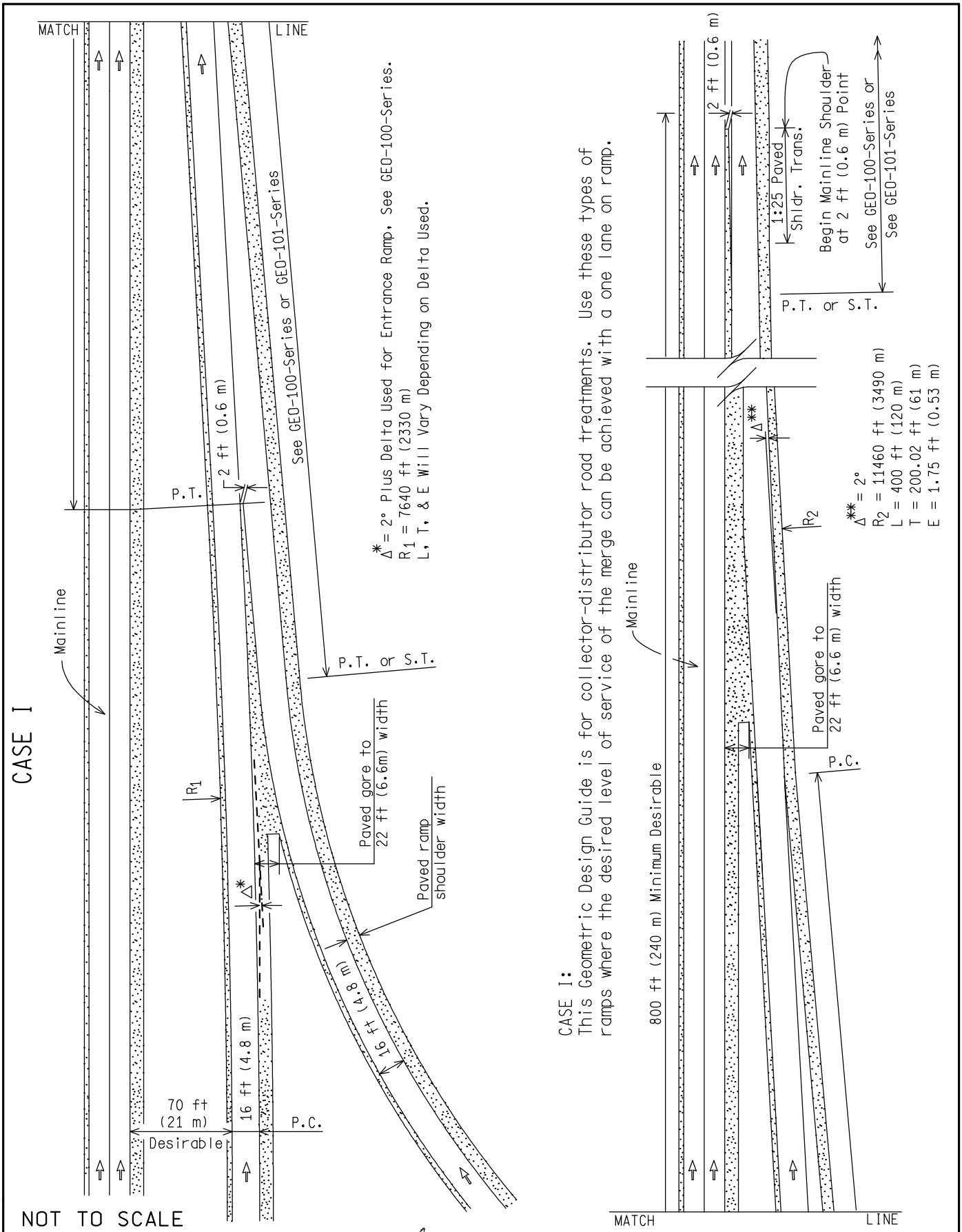
9. Each ramp should be carefully studied to provide maximum vision at its merge points. See Geometric Design Guide GEO-300-Series.

10. Two lane ramps should be 24 ft (7.2 m) minimum edge to edge. Radii less than 500 ft (150 m) may require widening, consult the Geometric Design Unit of Lansing Traffic and Safety.

11. The longitudinal joint on a 24 foot (7.2m) ramp pavement shall be located 12 feet (3.6m) from the right edge of the pavement and ended where the ramp width becomes 16 feet (4.8m).

12. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE



MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

DRAWN BY: LPS/ECH
CHECKED BY: JAT/IRG
FILE: PW/RD/TS/Geom D/mdot GEO120C EOC.dgn

BY: John C. Friend
ENGINEER OF DELIVERY

BY: Lois S. Pollard
ENGINEER OF DEVELOPMENT

REV. 09/06/2007

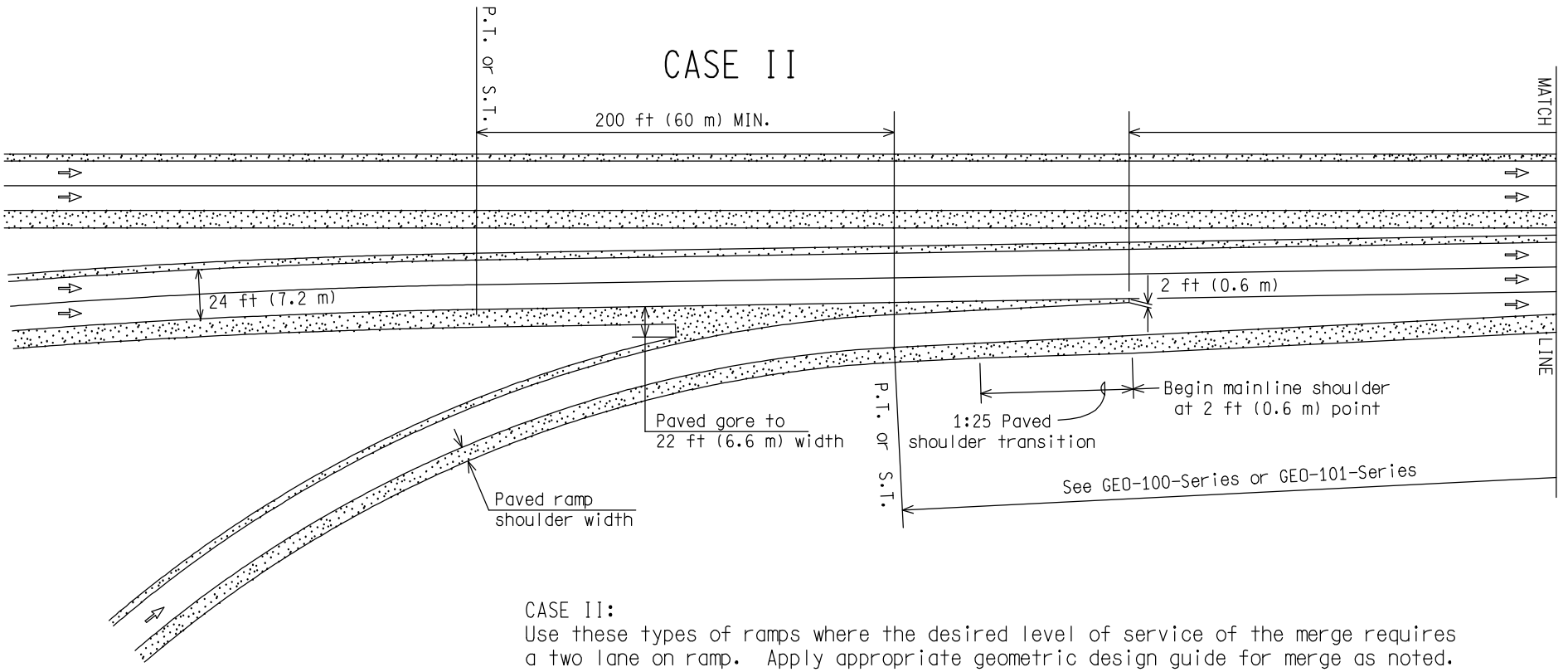
GEOMETRIC DESIGN GUIDE FOR
SUCCESSIVE ENTRANCE RAMPS

09/06/2007
PLAN DATE:

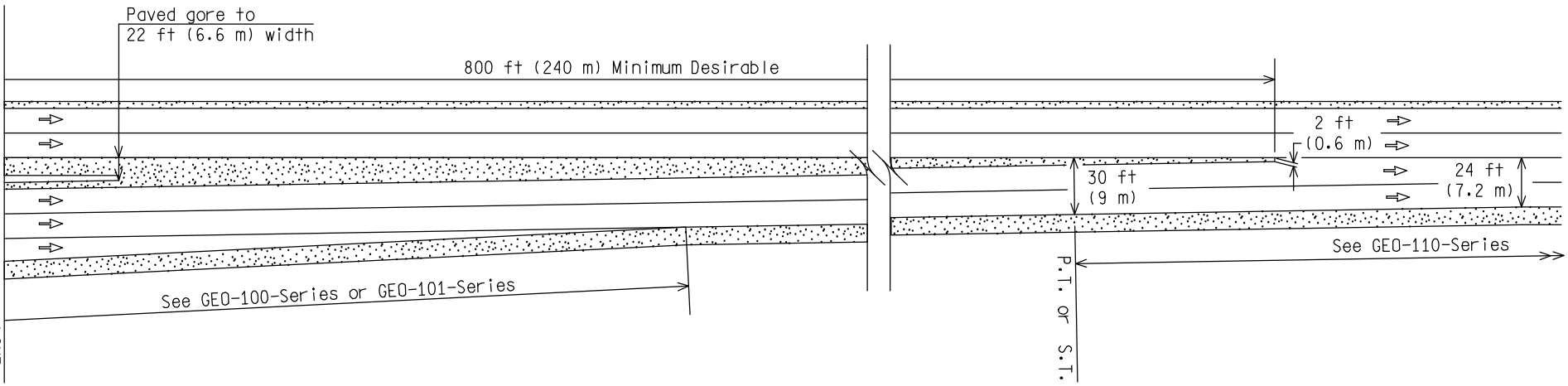
GEO-120-C

NOT TO SCALE

CASE II



CASE II:
Use these types of ramps where the desired level of service of the merge requires a two lane on ramp. Apply appropriate geometric design guide for merge as noted.



NOTES:

1. Select design speed based on combination of the superelevation rate and the radius of the curve. See chapter 3 of the MDOT Road Design Manual.

2. The design speed of the collector-distributor (C-D) roadway is generally 60 mph (100 km/hr).

3. If the through pavement is curved, plot offsets for the taper and connect with the appropriate curve.

4. Spiral transitions should be used on new ramp alignments, based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. The table gives the maximum radius in which a spiral should be used.

5. The cross slope in the gore area between the 2 ft (0.6 m) point and the 22 ft (6.6 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope difference between the gore and the adjacent lane. This algebraic difference also applies within crowned gores.

6. The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

7. The mainline shoulder width should extend along the ramp to where the gore is 2 ft (0.6 m) wide. Use a 1:25 taper transition where it joins the ramp shoulder paving.

8. Each ramp should be carefully studied to provide maximum vision at its merge points. See Geometric Design Guide GEO-300-Series.

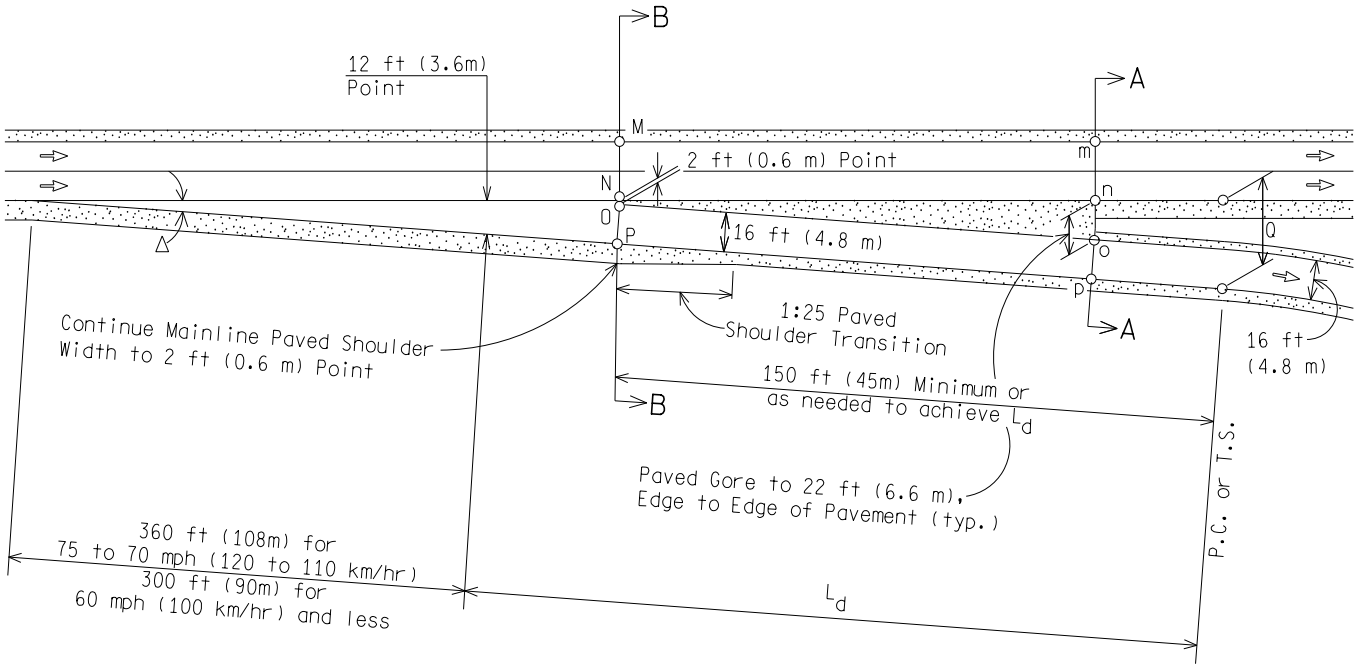
9. Two lane ramps should be 24 ft (7.2 m) minimum edge to edge. Radii less than 500 ft (150 m) may require lane widening, consult the Geometric Design Unit of Lansing Traffic and Safety.

10. The longitudinal joint on a 24 foot (7.2 m) ramp pavement shall be located 12 feet (3.6 m) from the right edge of the pavement and ended where the ramp width becomes 16 feet (4.8 m).

11. These design concepts are for new construction. Where modifications may be needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

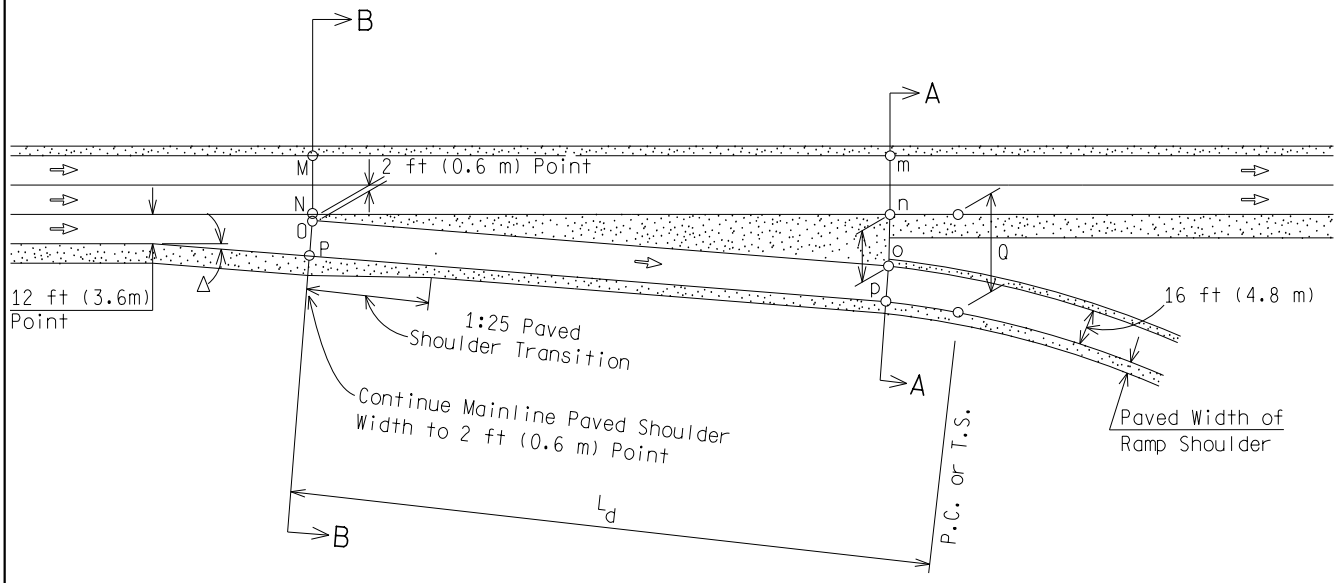
NOT TO SCALE

CASE I



CASE II

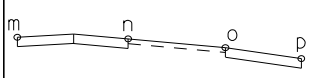
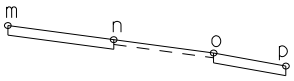
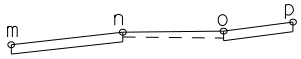
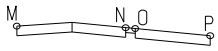
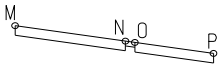
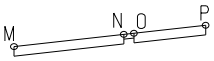
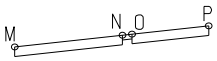
Use on ramps in weave sections.



NOT TO SCALE

MDOT Michigan Department of Transportation TRAFFIC AND SAFETY	BY: John C. Friend ENGINEER OF DELIVERY	GEOMETRIC DESIGN GUIDE FOR ONE-LANE TAPERED EXIT RAMP
DRAWN BY: ECH CHECKED BY: IRG/JAT	BY: ENGINEER OF DEVELOPMENT	08/07/2008 PLAN DATE: GEO-130-D SHEET 1 OF 5
FILE:PW: Geometrics/mdot traffic GEO-130-D.dgn	REV. 09/14/2016 MS	

EDGE OF PAVEMENT ELEVATION RELATIONSHIPS

WHEN THE THRU LANES ARE NOT SUPERELEVATED	WHEN THE THRU LANES ARE SUPERELEVATED AND N IS LOWER THAN M	WHEN THE THRU LANES ARE SUPERELEVATED AND N IS HIGHER THAN M	
		RAMP AND THRU LANE SUPERELEVATED IN SAME DIRECTION	RAMP AND THRU LANE SUPERELEVATED IN OPPOSITE DIRECTION
SECTION A-A			
 POINTS n, o & p SHOULD BE PROGRESSIVELY LOWER.	 POINTS m, n, o & p SHOULD BE PROGRESSIVELY LOWER.	 POINT o SHOULD BE HIGHER THAN POINT n.	 POINT o SHOULD BE EQUAL TO OR LOWER THAN POINT n.
SECTION B-B			
 POINTS N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.

NOTE: Maximum algebraic difference in pavement cross slope between mainline and ramp auxiliary lane should not exceed 5%.

NOT TO SCALE

MINIMUM ENGLISH LENGTHS FOR TAPERED EXIT RAMPS

RAMP DESIGN SPEED (MPH)	PERCENT GRADE OF THROUGH ROADWAY	TAPER=30:1 Δ=1°54′33″ ROADWAY DESIGN SPEED = 75 MPH L_d min = 330		TAPER=30:1 Δ=1°54′33″ ROADWAY DESIGN SPEED = 70 MPH L_d min = 330		TAPER=25:1 Δ=2°17′26″ ROADWAY DESIGN SPEED = 60 MPH L_d min = 300		TAPER=25:1 Δ=2°17′26″ ROADWAY DESIGN SPEED = 55 MPH TO 50 MPH L_d min = 300		TAPER=25:1 Δ=2°17′26″ ROADWAY DESIGN SPEED = 45 MPH OR LESS L_d min = 300	
		L_d (FT)	Q (FT)	L_d (FT)	Q (FT)	L_d (FT)	Q (FT)	L_d (FT)	Q (FT)	L_d (FT)	Q (FT)
20	-3 TO LESS THAN -5	744	36.8	684	34.8	576	35.1	528	33.2	390	27.6
	BETWEEN -3 AND +3	620	32.7	570	31.0	480	31.2	440	29.6	325	25.0
	+3 TO LESS THAN +5	558	30.6	513	29.1	432	29.3	396	27.9	300	24.0
25	-3 TO LESS THAN -5	720	36.0	660	34.0	552	34.1	492	31.7	354	26.2
	BETWEEN -3 AND +3	600	32.0	550	30.4	460	30.4	410	28.4	300	24.0
	+3 TO LESS THAN +5	540	30.0	495	28.5	414	28.6	369	26.8	300	24.0
30	-3 TO LESS THAN -5	690	35.0	624	32.8	516	32.7	456	30.3	300	24.0
	BETWEEN -3 AND +3	575	31.2	520	29.4	430	29.2	380	27.2	300	24.0
	+3 TO LESS THAN +5	518	29.3	468	27.6	387	27.5	342	25.7	300	24.0
35	-3 TO LESS THAN -5	642	33.4	588	31.6	486	31.5	420	28.8	300	24.0
	BETWEEN -3 AND +3	535	29.9	490	28.4	405	28.2	350	26.0	300	24.0
	+3 TO LESS THAN +5	482	28.1	441	26.7	365	26.6	315	24.6	300	24.0
40	-3 TO LESS THAN -5	588	31.6	528	29.6	420	28.8	342	25.7	300	24.0
	BETWEEN -3 AND +3	490	28.4	440	26.7	350	26.0	300	24.0	300	24.0
	+3 TO LESS THAN +5	441	26.7	396	25.2	315	24.6	300	24.0	300	24.0
45	-3 TO LESS THAN -5	528	29.6	468	27.6	360	26.4	300	24.0	300	24.0
	BETWEEN -3 AND +3	440	26.7	390	25.0	300	24.0	300	24.0	300	24.0
	+3 TO LESS THAN +5	396	25.2	351	23.7	300	24.0	300	24.0	300	24.0
50	-3 TO LESS THAN -5	468	27.6	432	26.4	300	24.0	300	24.0		
	BETWEEN -3 AND +3	390	25.0	360	24.0	300	24.0	300	24.0		
	+3 TO LESS THAN +5	351	23.7	330	23.0	300	24.0	300	24.0		
55	-3 TO LESS THAN -5	468	27.6	432	26.4	300	24.0	300	24.0		
	BETWEEN -3 AND +3	390	25.0	360	24.0	300	24.0	300	24.0		
	+3 TO LESS THAN +5	351	23.7	330	23.0	300	24.0	300	24.0		
60	-3 TO LESS THAN -5	468	27.6	432	26.4	300	24.0				
	BETWEEN -3 AND +3	390	25.0	360	24.0	300	24.0				
	+3 TO LESS THAN +5	351	23.7	330	23.0	300	24.0				
65	-3 TO LESS THAN -5	468	27.6	432	26.4						
	BETWEEN -3 AND +3	390	25.0	360	24.0						
	+3 TO LESS THAN +5	351	23.7	330	23.0						
70	-3 TO LESS THAN -5	468	27.6	432	26.4						
	BETWEEN -3 AND +3	390	25.0	360	24.0						
	+3 TO LESS THAN +5	351	23.7	330	23.0						
75	-3 TO LESS THAN -5	468	27.6								
	BETWEEN -3 AND +3	390	25.0								
	+3 TO LESS THAN +5	351	23.7								

NOT TO SCALE

MINIMUM METRIC LENGTHS FOR TAPERED EXIT RAMPS

RAMP DESIGN SPEED (km/hr)	PERCENT GRADE OF THROUGH ROADWAY	TAPER=30:1 Δ=1°54'33" ROADWAY DESIGN SPEED = 120 Km/Hr L_d min = 100		TAPER=30:1 Δ=1°54'33" ROADWAY DESIGN SPEED = 110 Km/Hr L_d min = 100		TAPER=25:1 Δ=2°17'26" ROADWAY DESIGN SPEED = 100 Km/Hr L_d min = 90		TAPER=25:1 Δ=2°17'26" ROADWAY DESIGN SPEED = 90 Km/Hr to 80 Km/Hr L_d min = 90		TAPER=25:1 Δ=2°17'26" ROADWAY DESIGN SPEED = 70 Km/Hr OR LESS L_d min = 90	
		L_d (m)	Q (m)	L_d (m)	Q (m)	L_d (m)	Q (m)	L_d (m)	Q (m)	L_d (m)	Q (m)
30	-3 TO LESS THAN -5	222	11.0	204	10.4	186	11.0	162	10.1	114	8.2
	BETWEEN -3 AND +3	185	9.8	170	9.3	155	9.8	135	9.0	95	7.4
	+3 TO LESS THAN +5	167	9.2	153	8.7	140	9.2	122	8.5	90	7.2
40	-3 TO LESS THAN -5	210	10.6	192	10.0	174	10.6	144	9.4	109	8.0
	BETWEEN -3 AND +3	175	9.4	160	8.9	145	9.4	120	8.4	90	7.2
	+3 TO LESS THAN +5	158	8.9	144	8.4	131	8.8	108	7.9	90	7.2
50	-3 TO LESS THAN -5	204	10.4	180	9.6	162	10.1	132	8.9	90	7.2
	BETWEEN -3 AND +3	170	9.3	150	8.6	135	9.0	110	8.0	90	7.2
	+3 TO LESS THAN +5	153	8.7	135	8.1	122	8.5	99	7.6	90	7.2
60	-3 TO LESS THAN -5	186	9.8	168	9.2	144	9.4	120	8.4	90	7.2
	BETWEEN -3 AND +3	155	8.8	140	8.3	120	8.4	100	7.6	90	7.2
	+3 TO LESS THAN +5	140	8.3	126	7.8	108	7.9	90	7.2	90	7.2
70	-3 TO LESS THAN -5	168	9.2	144	8.4	120	8.4	90	7.2	90	7.2
	BETWEEN -3 AND +3	140	8.3	120	7.6	100	7.6	90	7.2	90	7.2
	+3 TO LESS THAN +5	126	7.8	108	7.2	90	7.2	90	7.2	90	7.2
80	-3 TO LESS THAN -5	144	8.4	126	7.8	109	8.0	90	7.2		
	BETWEEN -3 AND +3	120	7.6	105	7.1	90	7.2	90	7.2		
	+3 TO LESS THAN +5	108	7.2	100	6.9	90	7.2	90	7.2		
90	-3 TO LESS THAN -5	144	8.4	126	7.8	109	8.0	90	7.2		
	BETWEEN -3 AND +3	120	7.6	105	7.1	90	7.2	90	7.2		
	+3 TO LESS THAN +5	108	7.2	100	6.9	90	7.2	90	7.2		
100	-3 TO LESS THAN -5	144	8.4	126	7.8	109	8.0				
	BETWEEN -3 AND +3	120	7.6	105	7.1	90	7.2				
	+3 TO LESS THAN +5	108	7.2	100	6.9	90	7.2				
110	-3 TO LESS THAN -5	144	8.4	126	7.8						
	BETWEEN -3 AND +3	120	7.6	105	7.1						
	+3 TO LESS THAN +5	108	7.2	100	6.9						
120	-3 TO LESS THAN -5	144	8.4								
	BETWEEN -3 AND +3	120	7.6								
	+3 TO LESS THAN +5	108	7.2								

NOT TO SCALE

NOTES:

1. The designer has the flexibility to choose the taper type ramp or the parallel type ramp. However, the same type of entrance and exit ramp should be used within an interchange and corridor. Uniformity in design is needed to aid driver expectancy. On sharp curves, it may be preferable to use parallel type ramp.

2. Select design speed based on a combination of the superelevation rate and the radius of the curve. See also chapter 3 of the MDOT Road Design Manual.

3. If an additional through lane is provided or the exit ramp leaves the mainline on the high side (outside) of the curve, use GEO-131-Series.

4. If the through pavement is curved, plot offsets for taper and connect with the appropriate curve.

5. Prepared detail grades and profiles from Section B-B through Section A-A.

6. Spirals transitions should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. The table gives the maximum radius in which a spiral should be used.

7. The maximum algebraic difference in pavement cross slope between the mainline and the ramp auxiliary lane should not exceed 5%.

8. The cross slope in the gore area between the 2 ft (0.6m) point and the 22 ft (6.6 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope between the gore and the adjacent paved lane. This algebraic difference also applies within crowned gores.

9. The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

10. The mainline shoulder width should extend along the ramp to where the gore is 2 ft (0.6 m) wide. Use a 1:25 taper transition where it joins the ramp shoulder paving.

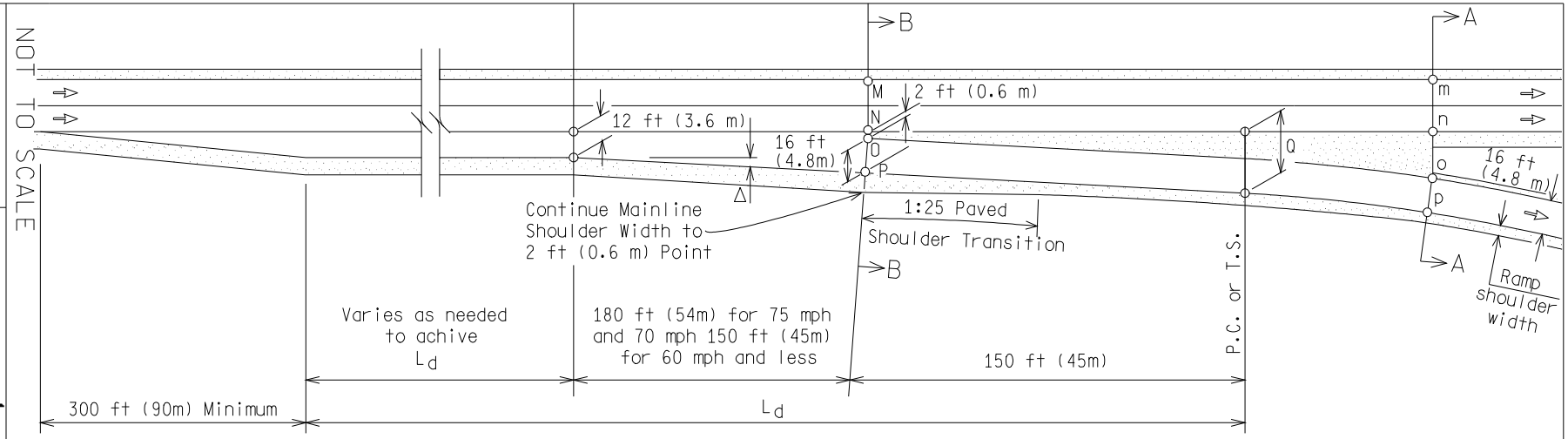
11. Each ramp will be carefully studied to provide maximum vision at its merge points. See Geometric Design Guide Geo-300-Series.

12. Caution must be used in positioning a taper type deceleration lane on a left turning highway. The exit should begin before or after the P.C. or S.T. to avoid having the appearance of an extension of the mainline to the motorist. Consider using a parallel type deceleration lane.

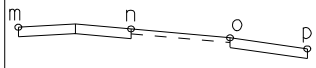
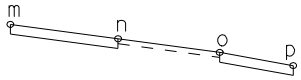
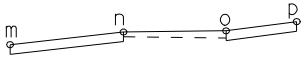
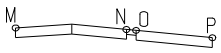
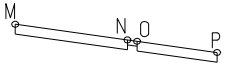
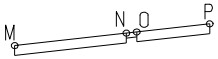
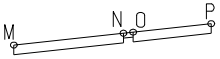
13. The sight distance in advance of the exit ramp gore should be at least 25% longer than the minimum stopping sight distance for the design speed of the mainline.

14. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult with the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE



EDGE OF PAVEMENT ELEVATION RELATIONSHIPS

When the through lanes are not superelecated	When the through lanes are superelevated and "N" is lower than "M"	When the through lanes are superelevated and "N" is higher than "M"	
		Ramp and through lane superelevated in same direction	Ramp and through lane superelevated in opposite direction
SECTION A-A			
			
Points n, o & p should be progressively lower.	Points m, n, o & p should be progressively lower.	Point o should be higher than point n.	Point o should be equal to or lower than point n.
SECTION B-B			
			
Points N, O & P should be in the same plane.	Points M, N, O & P should be in the same plane.	Points M, N, O & P should be in the same plane.	Points M, N, O & P should be in the same plane.

Note: Maximum algebraic difference in a pavement cross slope between mainline and ramp auxiliary lane should not exceed 5%

MDOT Michigan Department of Transportation

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CHECKED BY: IG/JAT
FILE:PW RD-TS-T-Geometrics/ GEO131D DEVDAT.dgn

BY: John C. Postell
ENGINEER OF DELIVERY

BY:
ENGINEER OF DEVELOPMENT

REV. 11/18/2008 jt

GEOMETRIC DESIGN GUIDE FOR

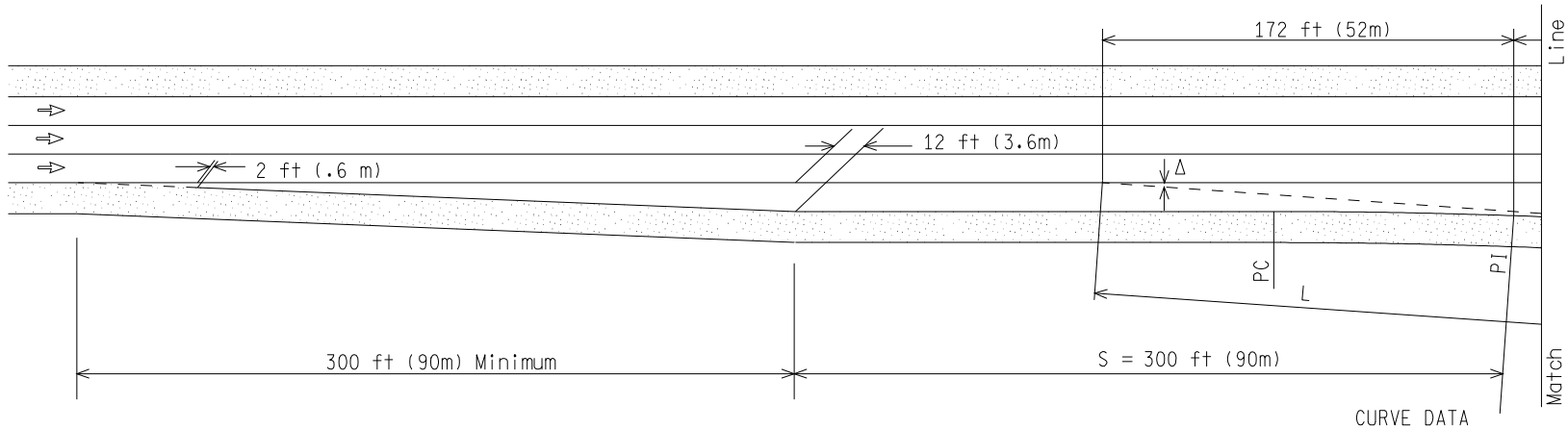
ONE-LANE PARALLEL EXIT RAMP

08/07/2008
PLAN DATE:

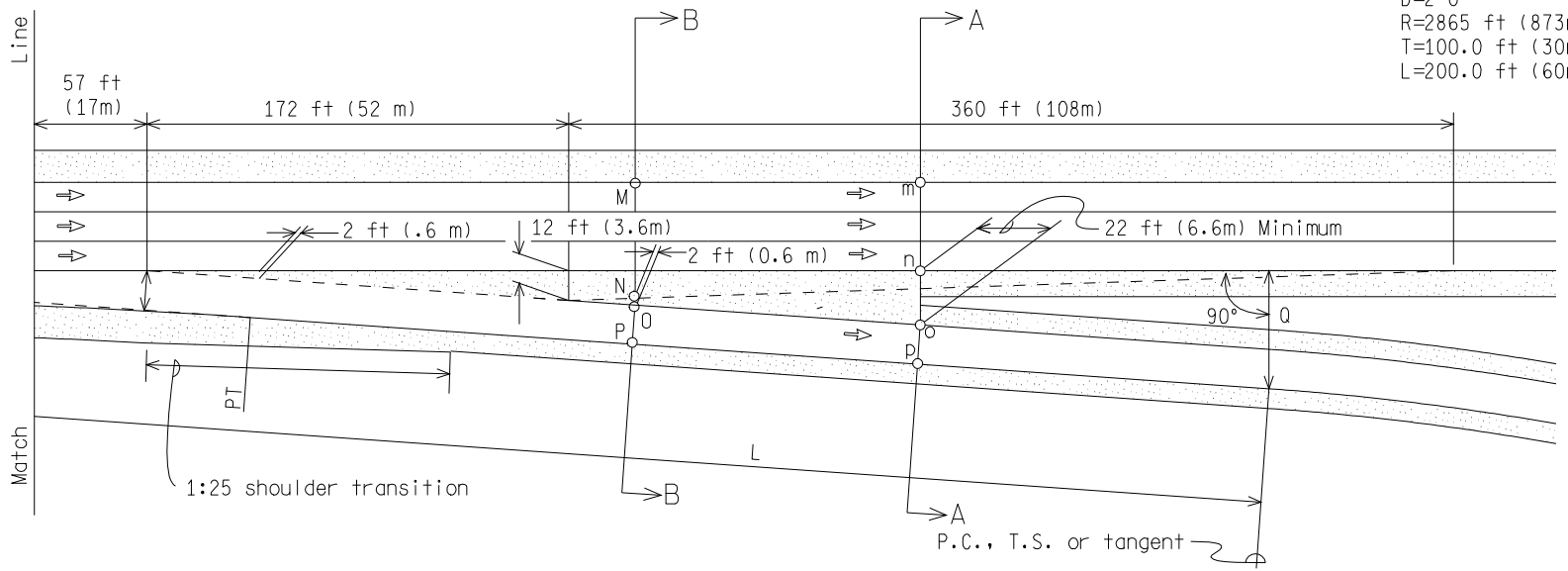
GEO-131-D

SHEET 1 OF 5

NOT TO SCALE



CURVE DATA
Δ=4°0′
D=2°0′
R=2865 ft (873m)
T=100.0 ft (30m)
L=200.0 ft (60m)



RAMP DIVERG. ANGLE	RAMP % GRADE	URBAN FREEWAY EXIT RAMP 60 MPH TO 30 MPH DECELERATION L	Q
△ =4°	-3 TO LESS THAN -5	687.6 ft (209.6 m)	48.0 ft (14.6 m)
	BETWEEN -3 AND +3	601.6 ft (183.4 m)	42.0 ft (12.8 m)
	+3 TO LESS THAN +5	558.6 ft (170.3 m)	39.0 ft (11.9 m)

NOTE:
SEE TABLES ON FOLLOWING SHEETS FOR FREEWAY SPEEDS OF 70 AND 75 MPH.

MINIMUM ENGLISH LENGTHS FOR PARALLEL EXIT RAMPS

RAMP DESIGN SPEED (MPH)	PERCENT GRADE OF THROUGH ROADWAY	TAPER=30:1 Δ=1°54′33″ ROADWAY DESIGN SPEED = 75 MPH Q = 23′ L_d min = 350′	TAPER=30:1 Δ=1°54′33″ ROADWAY DESIGN SPEED = 70 MPH Q = 23′ L_d min = 350′	TAPER=25:1 Δ=2°17′26″ ROADWAY DESIGN SPEED = 60 MPH Q = 24′ L_d min = 300′	TAPER=25:1 Δ=2°17′26″ ROADWAY DESIGN SPEED = 55 MPH TO 50 MPH Q = 24′ L_d min = 300′	TAPER=25:1 Δ=2°17′26″ ROADWAY DESIGN SPEED = 45 MPH OR LESS Q = 24′ L_d min = 300′
		L_d (FT)	L_d (FT)	L_d (FT)	L_d (FT)	L_d (FT)
20	-3 TO LESS THAN -5	744	684	576	528	390
	BETWEEN -3 AND +3	620	570	480	440	325
	+3 TO LESS THAN +5	558	513	432	396	300
25	-3 TO LESS THAN -5	720	660	552	492	354
	BETWEEN -3 AND +3	600	550	460	410	300
	+3 TO LESS THAN +5	540	495	414	369	300
30	-3 TO LESS THAN -5	690	624	516	456	300
	BETWEEN -3 AND +3	575	520	430	380	300
	+3 TO LESS THAN +5	518	468	387	342	300
35	-3 TO LESS THAN -5	642	588	486	420	300
	BETWEEN -3 AND +3	535	490	405	350	300
	+3 TO LESS THAN +5	482	441	365	315	300
40	-3 TO LESS THAN -5	588	528	420	342	300
	BETWEEN -3 AND +3	490	440	350	300	300
	+3 TO LESS THAN +5	441	396	315	300	300
45	-3 TO LESS THAN -5	528	468	360	300	300
	BETWEEN -3 AND +3	440	390	300	300	300
	+3 TO LESS THAN +5	396	351	300	300	300
50	-3 TO LESS THAN -5	468	432	300	300	
	BETWEEN -3 AND +3	390	360	300	300	
	+3 TO LESS THAN +5	351	350	300	300	
55	-3 TO LESS THAN -5	468	432	300	300	
	BETWEEN -3 AND +3	390	360	300	300	
	+3 TO LESS THAN +5	351	350	300	300	
60	-3 TO LESS THAN -5	468	432	300		
	BETWEEN -3 AND +3	390	360	300		
	+3 TO LESS THAN +5	351	350	300		
65	-3 TO LESS THAN -5	468	432			
	BETWEEN -3 AND +3	390	360			
	+3 TO LESS THAN +5	351	350			
70	-3 TO LESS THAN -5	468	432			
	BETWEEN -3 AND +3	390	360			
	+3 TO LESS THAN +5	351	350			
75	-3 TO LESS THAN -5	468				
	BETWEEN -3 AND +3	390				
	+3 TO LESS THAN +5	351				

Note: When an L_d value of 300′ is used for mainline design speeds of 60 mph and less, the parallel portion of the ramp is omitted, and the ramp taper connects directly with the mainline taper to form a uniform deflection (Δ).

NOT TO SCALE

MINIMUM METRIC LENGTHS FOR PARALLEL EXIT RAMPS

RAMP DESIGN SPEED (km/hr)	PERCENT GRADE OF THROUGH ROADWAY	TAPER=30:1 Δ=1°54′33″ ROADWAY DESIGN SPEED = 120 Km/Hr Q = 6.9m L_d min = 107	TAPER=30:1 Δ=1°54′33″ ROADWAY DESIGN SPEED = 110 Km/Hr Q = 6.9m L_d min = 107	TAPER=25:1 Δ=2°17′26″ ROADWAY DESIGN SPEED = 100 Km/Hr Q = 7.2m L_d min = 90	TAPER=25:1 Δ=2°17′26″ ROADWAY DESIGN SPEED = 90 Km/Hr to 80 Km/Hr Q = 7.2m L_d min = 90	TAPER=25:1 Δ=2°17′26″ ROADWAY DESIGN SPEED = 70 Km/Hr OR LESS Q = 7.2m L_d min = 90m
		L_d (m)	L_d (m)	L_d (m)	L_d (m)	L_d (m)
30	-3 TO LESS THAN -5	222	204	186	162	114
	BETWEEN -3 AND +3	185	170	155	135	95
	+3 TO LESS THAN +5	167	153	140	122	90
40	-3 TO LESS THAN -5	210	192	174	144	102
	BETWEEN -3 AND +3	175	160	145	120	90
	+3 TO LESS THAN +5	158	144	131	108	90
50	-3 TO LESS THAN -5	204	180	162	132	90
	BETWEEN -3 AND +3	170	150	135	110	90
	+3 TO LESS THAN +5	153	135	122	99	90
60	-3 TO LESS THAN -5	186	168	144	120	90
	BETWEEN -3 AND +3	155	140	120	100	90
	+3 TO LESS THAN +5	140	126	108	90	90
70	-3 TO LESS THAN -5	168	144	120	90	90
	BETWEEN -3 AND +3	140	120	100	90	90
	+3 TO LESS THAN +5	126	108	90	90	90
80	-3 TO LESS THAN -5	144	126	102	90	
	BETWEEN -3 AND +3	120	107	90	90	
	+3 TO LESS THAN +5	108	107	90	90	
90	-3 TO LESS THAN -5	144	126	102	90	
	BETWEEN -3 AND +3	120	107	90	90	
	+3 TO LESS THAN +5	108	107	90	90	
100	-3 TO LESS THAN -5	144	126	102		
	BETWEEN -3 AND +3	120	107	90		
	+3 TO LESS THAN +5	108	107	90		
110	-3 TO LESS THAN -5	144	126			
	BETWEEN -3 AND +3	120	107			
	+3 TO LESS THAN +5	108	107			
120	-3 TO LESS THAN -5	144				
	BETWEEN -3 AND +3	120				
	+3 TO LESS THAN +5	108				

Note: When an L_d value of 90m is used for mainline design speeds of 100 km/hr and less, the parallel portion of the ramp is omitted, and the ramp taper connects directly with the mainline taper to form a uniform deflection (Δ).

NOT TO SCALE

NOTES:

1. The designer has the flexibility to choose the taper type ramp or the parallel type ramp. However, the same type of entrance and exit ramp should be used within an interchange and corridor. Uniformity in design is needed to aid driver expectancy. On sharp curves, it may be preferable to use parallel type ramp.

2. Select the design speed based on a combination of the superelevation rate and the radius of the curve. See also chapter 3 of MDOT Road Design Manual.

3. If an additional through lane is provided or the exit ramp leaves the mainline on the high side (outside) of the curve, use GEO-131-Series.

4. If the through pavement is curved, plot offsets for taper and connect with appropriate curve.

5. Prepare detail grades and profiles from Section B-B through A-A.

6. Spiral transitions should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. The table gives the maximum radius in which a spiral should be used.

7. The maximum algebraic difference in pavement cross slope between the mainline and the ramp auxiliary lane should not exceed 5%.

8. The cross slope in the gore area between the 2 ft (0.6m) point and the 22 ft (6.6 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope between the gore and the adjacent paved lane. This algebraic difference also applies within crowned gores.

9. The design speed of the ramp vertical alignment shall match or exceed the design speed of the ramp horizontal alignment.

10. The mainline shoulder width should extend along the ramp to where the gore is 2 ft (0.6 m) wide. Use a 1:25 taper transition where it joins the ramp shoulder paving.

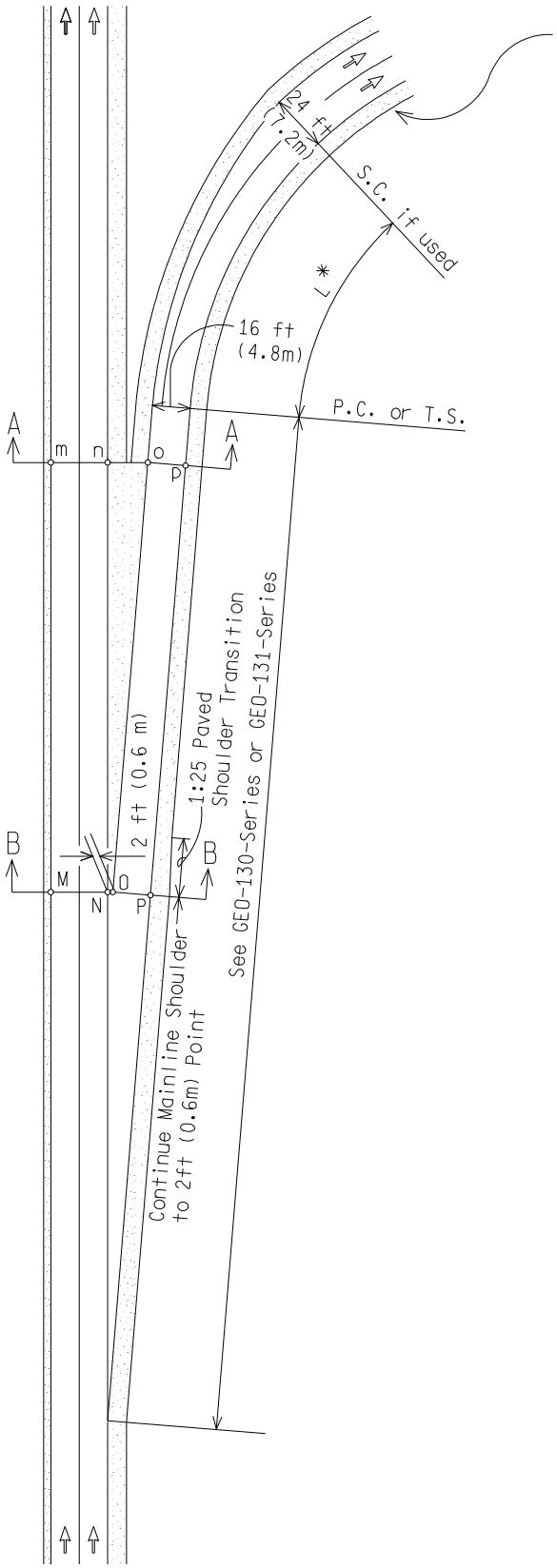
11. Each ramp shall be carefully studied to provide maximum vision at its merge points. See Geometric Design Guide Geo-300-Series.

12. The sight distance in advance of the exit ramp gore should be at least 25% longer than the minimum stopping sight distance for the design speed of the mainline.

13. These design concepts are for new construction. Where modifications may be needed for retrofitting to existing road features, consult with the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE

CASE I



CASE I:
Consider use on ramps longer than 3000 ft (914m) and when the desired level of diverge can be achieved with a one lane off ramp.

Calculation for Transition Length "L" (V = Design Speed)
L(ft)= 6 x Ramp Design Speed (mph) L(m) = 1.11 x Ramp Design speed (km/hr)
* Note: Transition from two lanes to one lane should be consistently on the left or the right within the interchange, if feasible.

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MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

DRAWN BY: ECH
CHECKED BY: JAT
FILE: PW RD-TS-T-Geometrics/GEO140B DEVJAT.dgn REV. 12/09/2008 jt

BY: John C. Friend
ENGINEER OF DELIVERY

BY:
ENGINEER OF DEVELOPMENT

GEOMETRIC DESIGN GUIDE FOR
TWO-LANE
EXIT RAMP

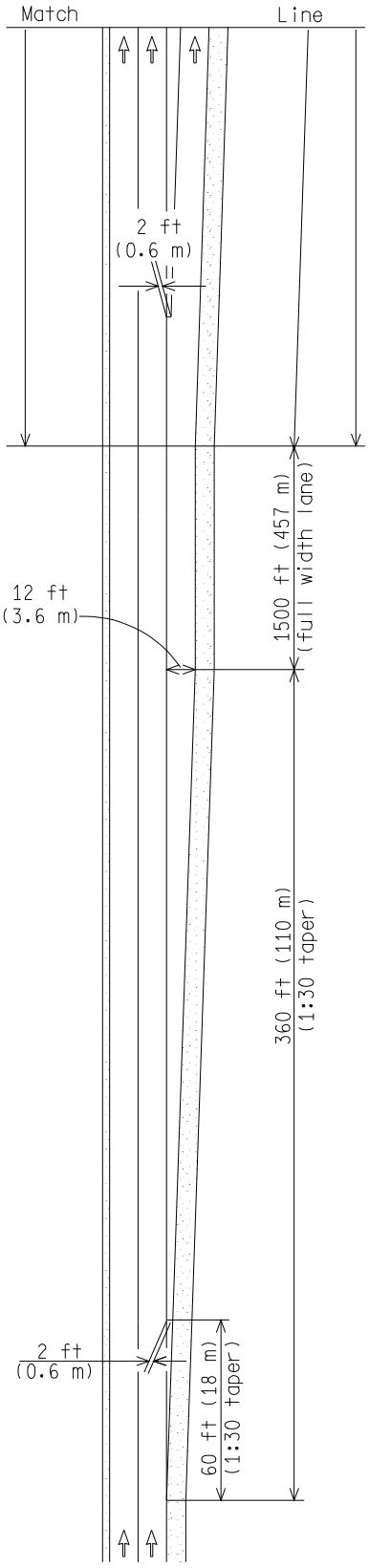
08/07/2008
PLAN DATE:

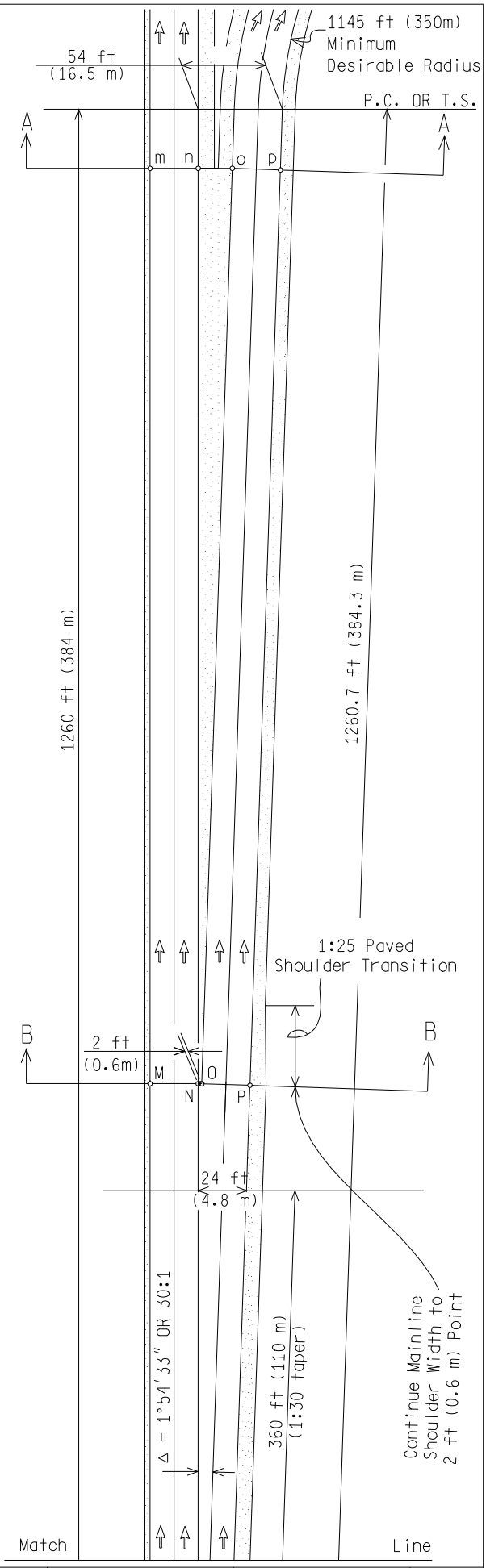
GEO-140-B

SHEET 1 OF 5

CASE II

CASE II:
Consider use on ramps where the desired level of service of the diverge requires a 2 lane off ramp.

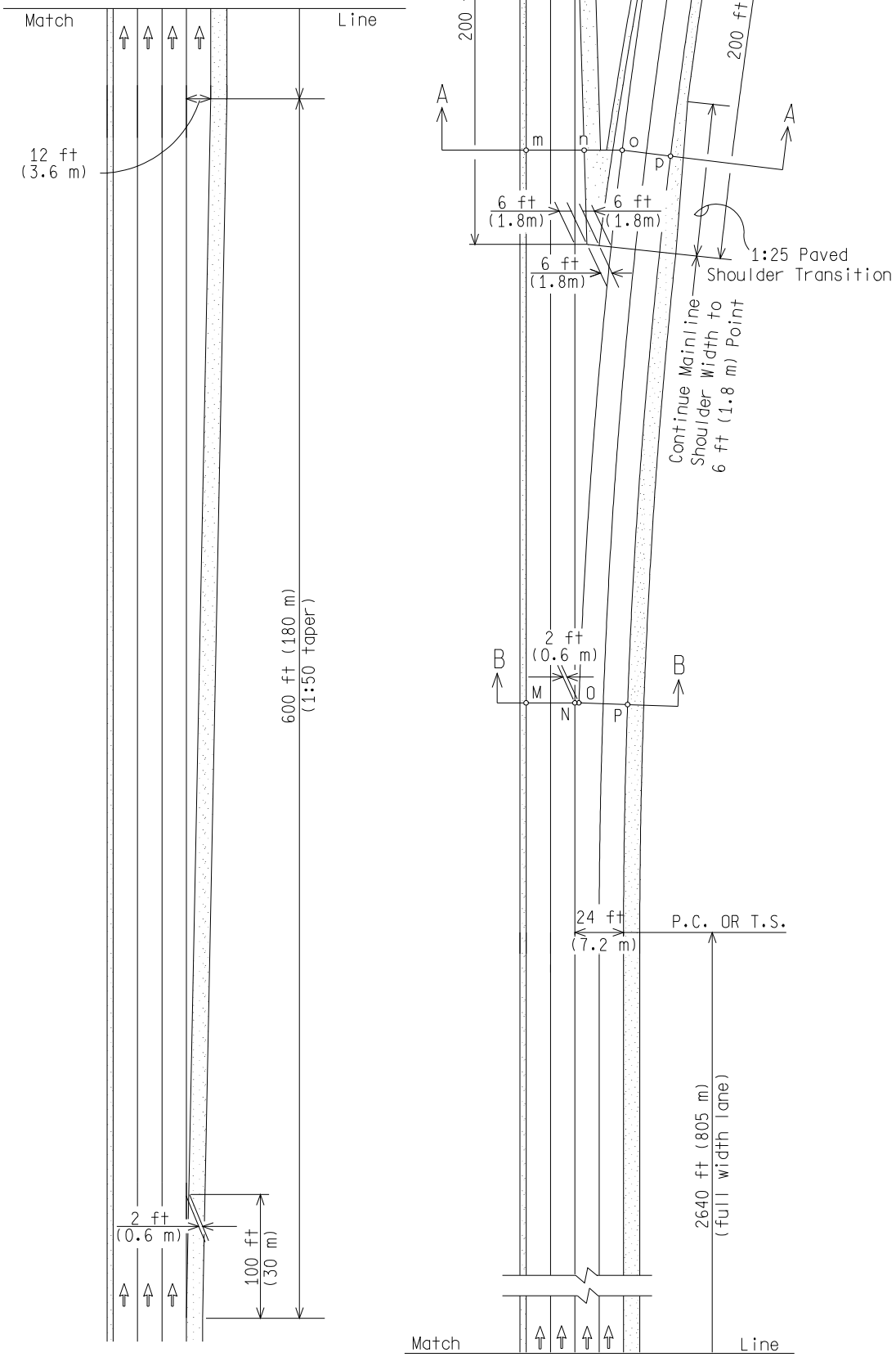




NOT TO SCALE

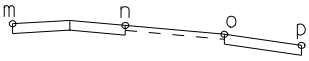
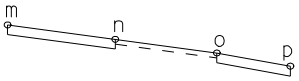
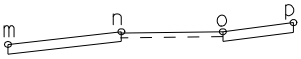
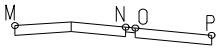
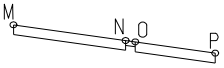
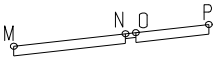
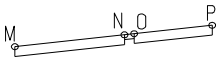
CASE III

CASE III: Consider use on ramps where a desired level of service cannot be maintained by CASE II. Also consider when the freeway lanes are reduced by one lane after the two-lane exit ramp.



NOT TO SCALE

EDGE OF PAVEMENT ELEVATION RELATIONSHIPS

WHEN THE THRU LANES ARE NOT SUPERELEVATED	WHEN THE THRU LANES ARE SUPERELEVATED AND N IS LOWER THAN M	WHEN THE THRU LANES ARE SUPERELEVATED AND N IS HIGHER THAN M	
		RAMP AND THRU LANE SUPERELEVATED IN SAME DIRECTION	RAMP AND THRU LANE SUPERELEVATED IN OPPOSITE DIRECTION
SECTION A-A			
 POINTS n, o & p SHOULD BE PROGRESSIVELY LOWER.	 POINTS m, n, o & p SHOULD BE PROGRESSIVELY LOWER.	 POINT o SHOULD BE HIGHER THAN POINT n.	 POINT o SHOULD BE EQUAL TO OR LOWER THAN POINT n.
SECTION B-B			
 POINTS N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.

NOTE: Maximum algebraic difference in pavement cross slope between mainline and ramp auxilary lane should not exceed 5%.

NOT TO SCALE

NOTES:

1. Select design speed based on a combination of the superelevation rate and the radius of the curve. See also chapter 3 of the MDOT Road Design Manual.

2. If an additional through lane is provided or the entrance ramp joins the mainline on the high side (outside) of the curve, use GEO-101-Series.

3. If the through pavement is curved, plot offsets for taper and connect with appropriate curve.

4. Prepare detail grades and profiles from Section A-A to Section B-B.

5. Spiral transitions should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. The table gives the maximum radius in which a spiral should be used.

6. The maximum algebraic difference in pavement cross slope between the mainline and the ramp auxiliary lane should not exceed 5%.

7. The cross slope in the gore area between the 2 ft (0.6m) point and the 22 ft (6.6 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope between the gore and the adjacent paved lane. This algebraic difference also applies within crowned gores.

8. The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

9. The mainline shoulder width should extend along the ramp to where the gore is 2 ft (0.6 m) wide. Use a 1:25 taper transition where it joins the ramp shoulder paving.

10. Each ramp should be carefully studied to provide maximum vision at its merge points. See Geometric Design Guide GEO-300-Series.

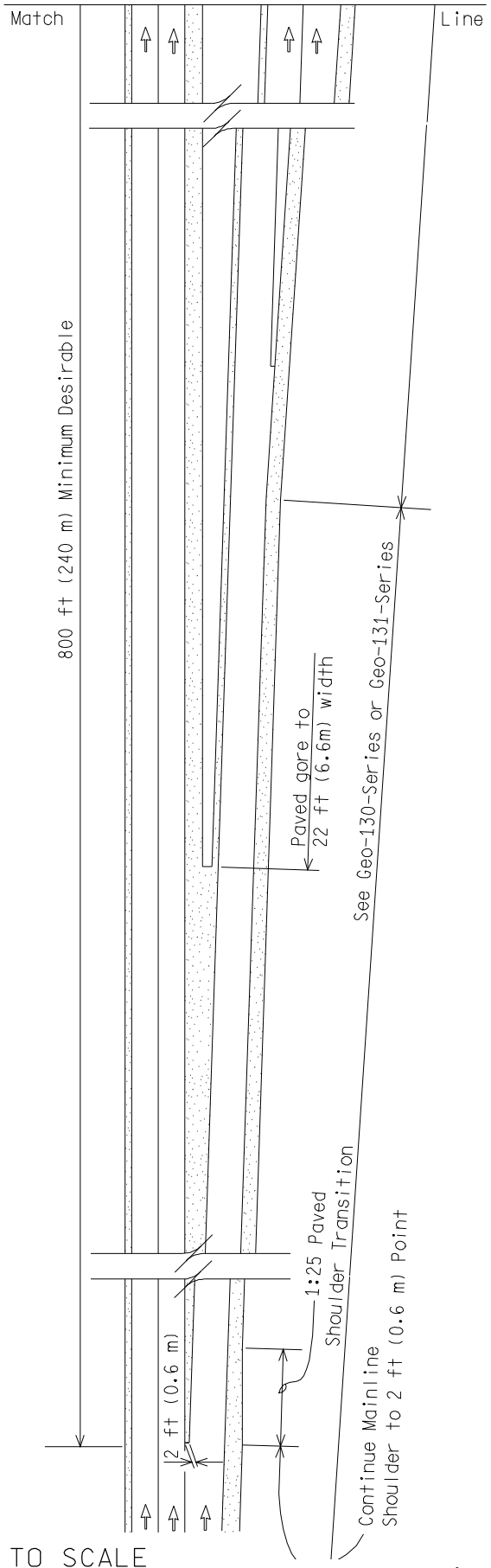
11. Two lane ramps should be 24 ft (7.2m) minimum edge to edge. Radii less than 500ft may require widening, consult the Geometric Design Unit of Lansing Traffic and Safety.

12. The longitudinal joint on a 24 ft (7.2m) ramp pavement shall be located 12 ft (3.6m) from the right edge of the pavement and ended where the ramp width becomes 16 ft (4.8m).

13. The sight distance in advance of the exit ramp gore should be at least 25% longer than the minimum stopping sight distance for the design speed of the mainline.

14. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE



CASE I

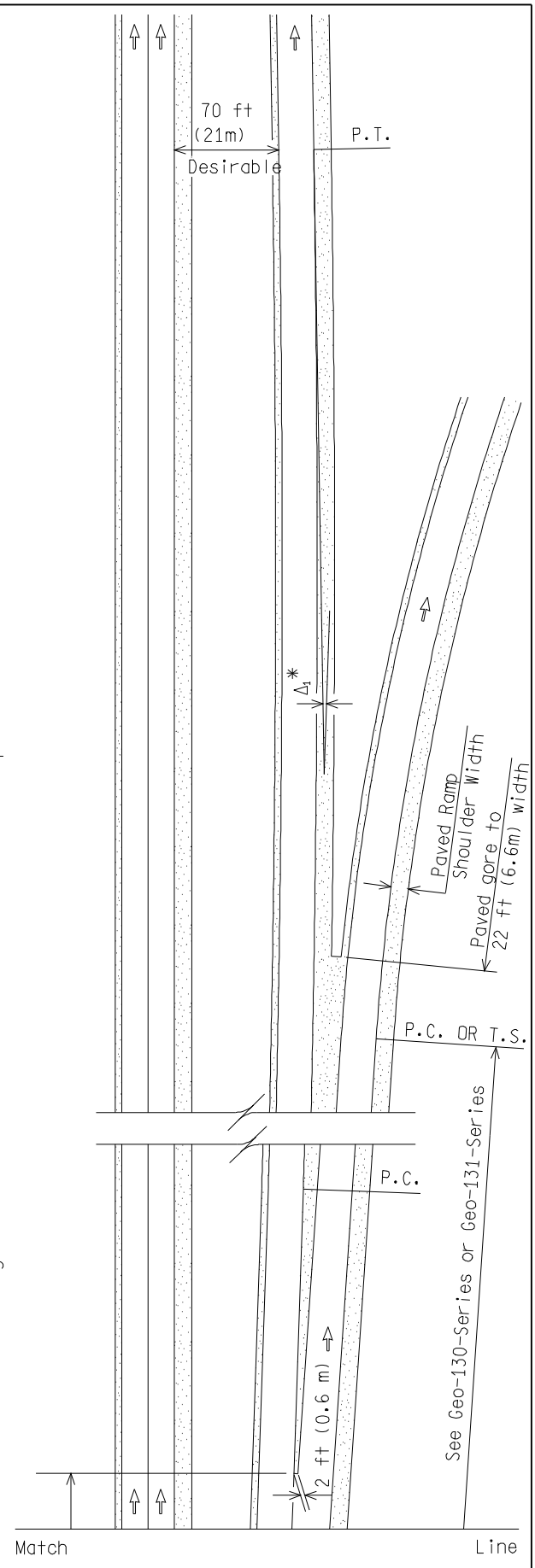
NOT TO SCALE

CASE I: This Geometric Design Guide is for collector-distributor road treatments. Use these types or ramps where the desired level of secvice of the diverge can be achieved with a one lane off ramp.

*Δ_1= Delta used for exit ramp, see Geo-130-Series or Geo-131-Series

R = 11460 ft (3493m)

L, T, & E Will Vary Depending on Delta Used.



MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

BY: John C. Friend
ENGINEER OF DELIVERY

BY:
ENGINEER OF DEVELOPMENT

DRAWN BY: ECH
CHECKED BY: JAT
FILE:PW D RD TS T D Geom D/GEO150C DevJat
REV. 09/22/2008 JK

GEOMETRIC DESIGN GUIDE FOR

SUCCESSIVE EXIT RAMPS

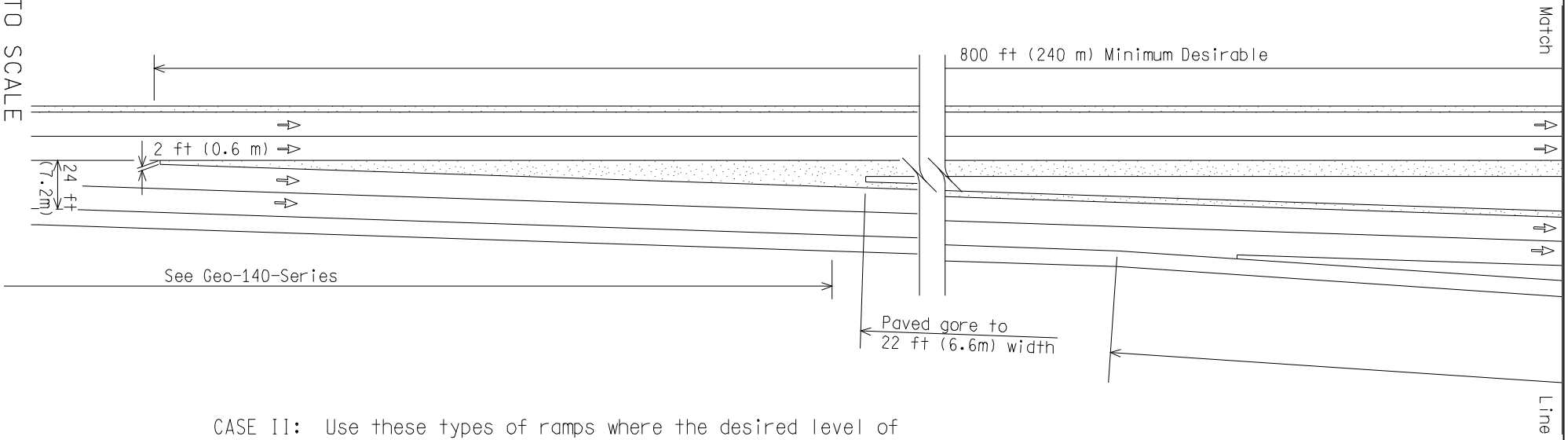
08/07/2008
PLAN DATE:

GEO-150-C

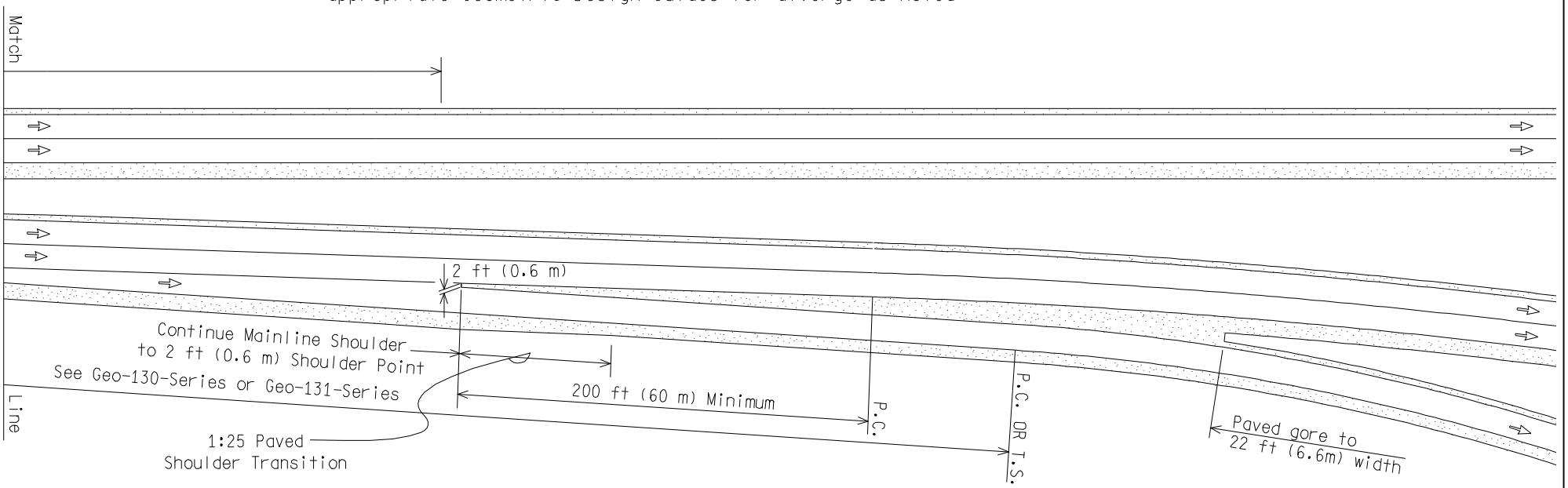
SHEET 1 OF 3

NOT TO SCALE

CASE II



CASE II: Use these types of ramps where the desired level of service of the diverge requires a two lane off ramp. Apply appropriate Geometric Design Guides for diverge as noted.



MICHIGAN DEPARTMENT OF TRANSPORTATION TRAFFIC AND SAFETY GEOMETRIC DESIGN GUIDE

FILE:PW D RD TS T D Geom D/GEO150C Devjat

REV. 09/22/2008 JK

PLAN DATE: 08/07/2008

GEO-150-C

SHEET 2 OF 3

NOTES:

1. Select the design speed based on a combination of the superelevation rate and the radius of the curve. See also chapter 3 of the MDOT Road Design Manual.

2. The design speed of the collector-distributor (C-D) roadway is generally 60 mph (100 km/hr).

3. If the through pavement is curved, plot offsets for taper and connect with the appropriate curve.

4. Spiral transitions should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. The table gives the maximum radius in which a spiral should be used.

5. The cross slope in the gore area between the 2 ft (0.6m) point and the 22 ft (6.7 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope between the gore and the adjacent lane. This algebraic difference also applies within crowned gores.

6. The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

7. The mainline shoulder width should extend along the ramp to where the gore is 2 ft (0.6 m) wide. Use a 1:25 taper transition where it joins the ramp shoulder paving.

8. Each ramp shall be carefully studied to provide maximum vision at its merge points. See Geometic Design Guide Geo-300-Series.

9. The sight distance in advance of the exit ramp gore should be at least 25% longer than the minimum stopping sight distance for the design speed of the mainline.

10. Two lane ramps should be 24 ft (7.2 m) minimum edge to edge. Radii less than 500 ft (150 m) may require lane widening, consult the Geometric Design Unit of Lansing Traffic and Safety.

11. The longitudinal joint on a 24 foot (7.2 m) ramp pavement shall be located 12 feet (3.6 m) from the right edge of the pavement and ended where the ramp width becomes 16 feet (4.8 m).

12. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE

MDOT
Michigan Department of Transportation
TRAFFIC AND SAFETY

DRAWN BY: ECH
CHECKED BY: JAT
FILE:PW D RD TS T D Geom D/GEO202B DevJAT.DGN

BY: John C. Friedl
ENGINEER OF DELIVERY

BY: Paul A Van Poppel
ENGINEER OF DEVELOPMENT

REV. 07/13/2021 MS

GEOMETRIC DESIGN GUIDE FOR 12' WIDTH ENTRANCE AND EXIT SLIP RAMPS

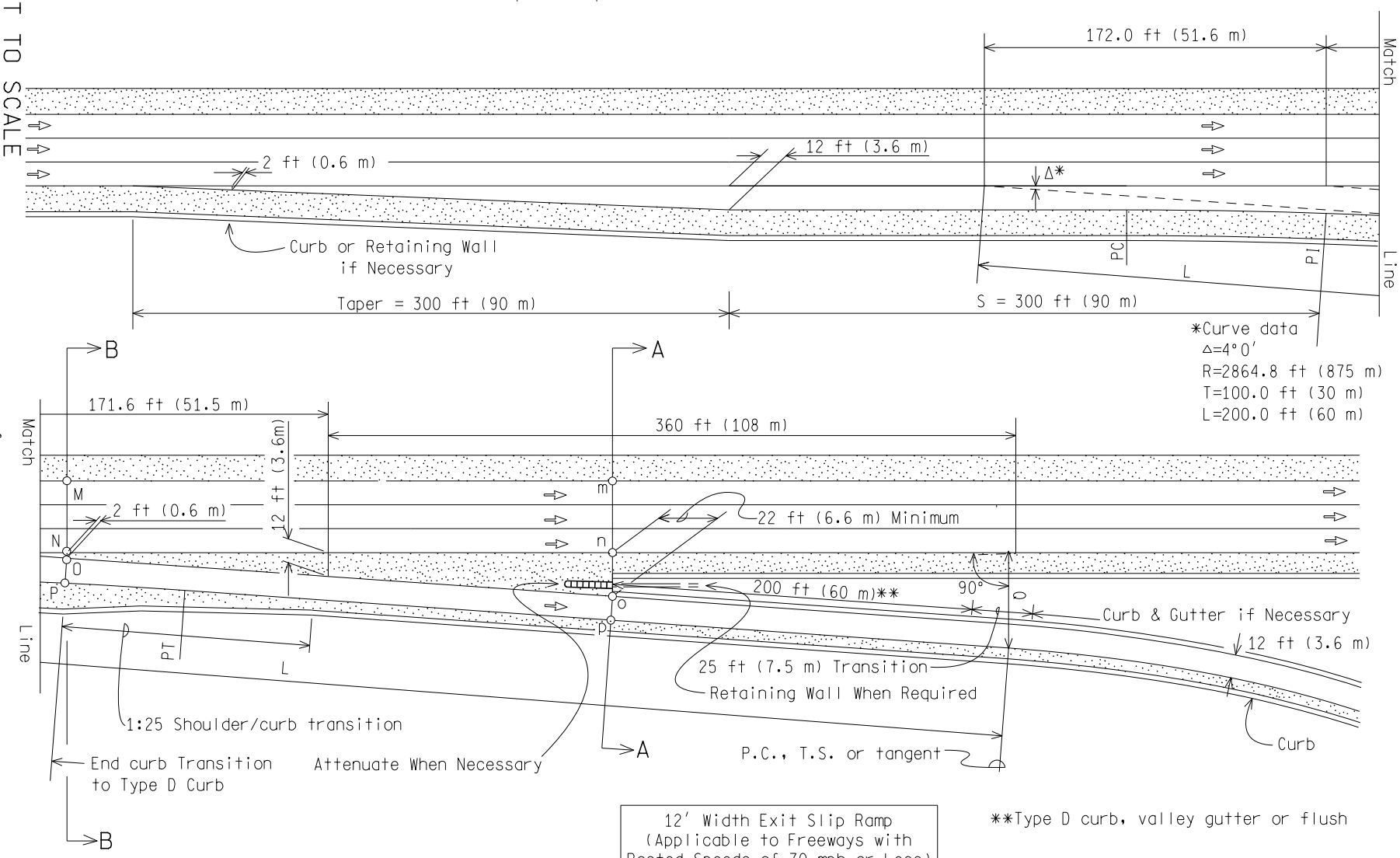
08/07/2008
PLAN DATE:

GEO-202-B

SHEET 1 OF 4

NOT TO SCALE

Exit Slip Ramp



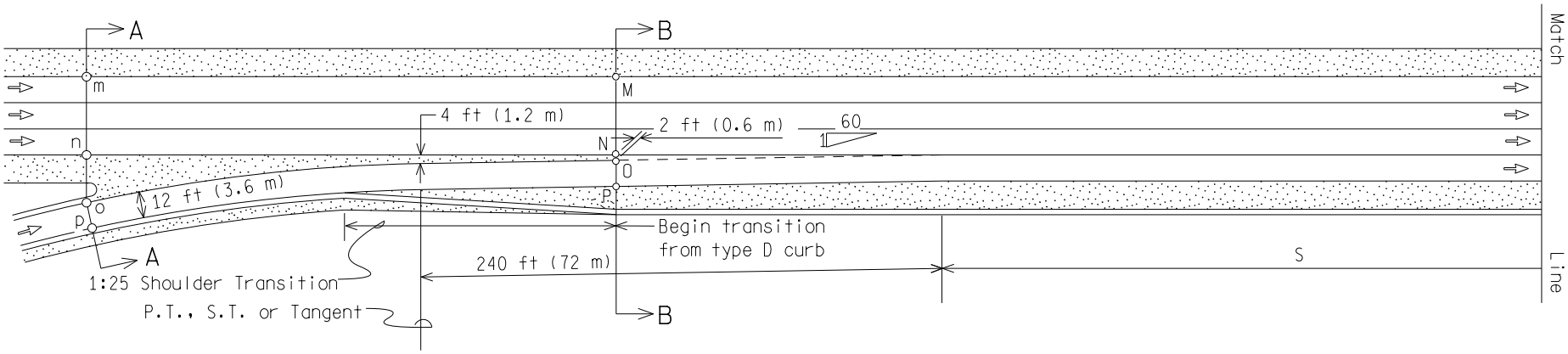
12′ Width Exit Slip Ramp (Applicable to Freeways with Posted Speeds of 70 mph or Less)					
RAMP DIVERGE ANGLE	RAMP % GRADE	L		Q	
		(ft)	(m)	(ft)	(m)
△ =4°	-3 to LESS THAN -5	687.6	213.5	48.0	14.9
	BETWEEN -3 AND +3	601.6	186.5	42.0	13.0
	+3 to LESS THAN +5	558.6	173.0	39.0	12.1

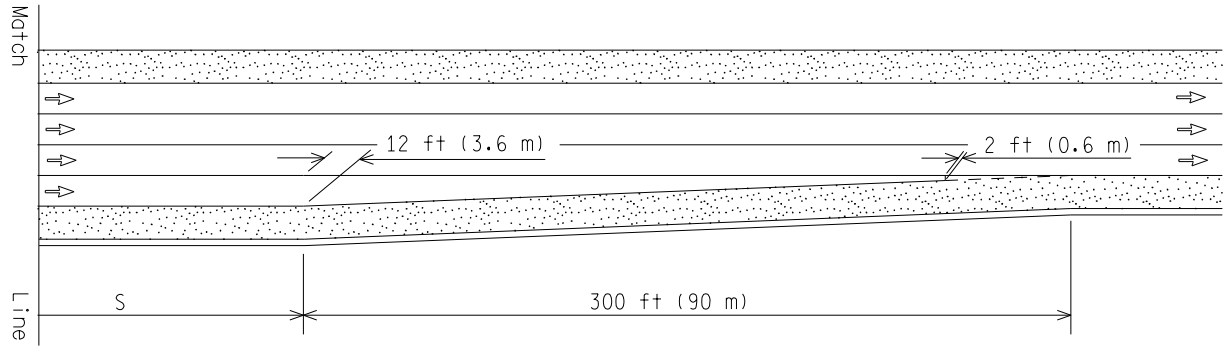
**Type D curb, valley gutter or flush

Note: Refer to Appendix 6-A of the current Road Design Manual for curb type and placement.

Entrance Slip Ramp

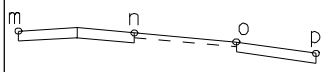
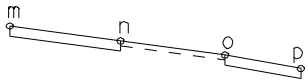
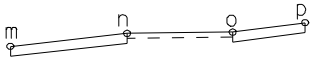
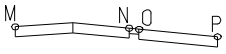
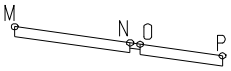
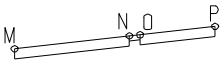
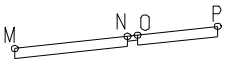
NOT TO SCALE





12' Width Entrance Slip Ramp (Applicable to Freeways with Posted Speeds of 70 mph or Less)		
PERCENT GRADE OF THROUGH ROADWAY	S	
	(ft)	(m)
-3 to LESS THAN -5	380	115
BETWEEN -3 AND +3	680	185
+3 to LESS THAN +5	1080	340

EDGE OF PAVEMENT ELEVATION RELATIONSHIPS

WHEN THE THRU LANES ARE NOT SUPERELEVATED	WHEN THE THRU LANES ARE SUPERELEVATED AND N IS LOWER THAN M	WHEN THE THRU LANES ARE SUPERELEVATED AND N IS HIGHER THAN M	
		RAMP AND THRU LANE SUPERELEVATED IN SAME DIRECTION	RAMP AND THRU LANE SUPERELEVATED IN OPPOSITE DIRECTION
SECTION A-A			
 POINTS n, o & p SHOULD BE PROGRESSIVELY LOWER.	 POINTS m, n, o & p SHOULD BE PROGRESSIVELY LOWER.	 POINT o SHOULD BE HIGHER THAN POINT n.	 POINT o SHOULD BE EQUAL TO OR LOWER THAN POINT n.
SECTION B-B			
 POINTS N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.	 POINTS M, N, O & P SHOULD BE IN THE SAME PLANE.

NOTE: Maximum algebraic difference in pavement cross slope between mainline and ramp auxilary lane should not exceed 5%.

NOT TO SCALE

NOTES:

1. Select design speed based on a combination of the super elevation rate and the radius of the curve. See also chapter 3 of the MDOT Road Design Manual.

2. If an additional through lane is provided or the entrance ramp joins the mainline on the high side (outside) of the curve, use GEO-101-Series.

3. If the through pavement is curve, plot offsets for taper and connect with appropriate curve.

4. Prepare detail grades and profiles from Section A-A to Section B-B.

5. A curve on the exit ramp beyond the gore may be introduced when necessary but should have a 1145 ft (350m) minimum radius for slip exit ramps.

6. Radii less than 500 ft (105m) would require lane widening to 16 ft (4.8m).

7. A parallel entrance acceleration lane length "S" of at least 1080' (324 m), plus taper, is desirable wherever it is anticipated that the ramp and freeway will carry traffic volumes approximately equal to the design capacity of the merging area.

8. Spirals transition should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. The table gives the Maximum radius in which a spiral should be used.

9. The maximum algebraic difference in pavement cross slope between the mainline and the ramp auxiliary lane should not exceed 5%.

10. Super elevation should conform to Standard Plan R-107-Series. The maximum rate of super elevation for ramp curves should be 5%.

11. The cross slope in the gore area between the 2 ft (0.6m) point and the 22 ft (6.6 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope between the gore and the adjacent paved lane. The algebraic difference also applies within crowned gores.

12. The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

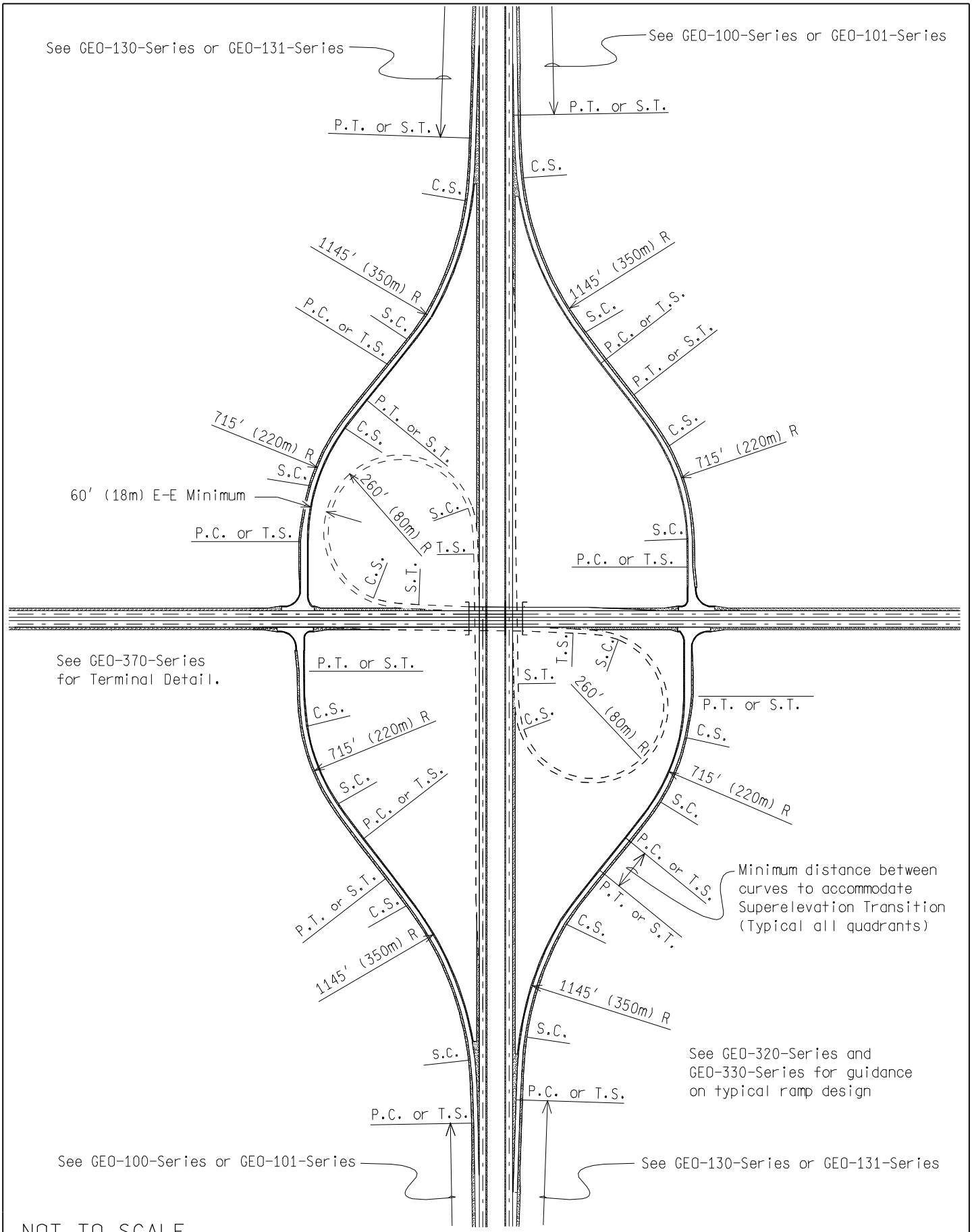
13. The mainline shoulder width should extend along the ramp to where the gore is 2 ft (0.6 m) wide. Use a 1:25 taper transition where it joins the ramp shoulder paving.

14. Each ramp should be carefully studied to provide maximum vision at their merge points. See Geometric Design Guide GEO-300-Series.

15. The sight distance in advance of the exit ramp gore should be at least 25% longer than the minimum stopping sight distance for the design speed of the mainline.

16. These design concepts are for new construction. Where modifications are needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE



NOT TO SCALE

MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

BY: John C. Friend
ENGINEER OF DELIVERY

BY: Mark A. VanPortfleet
ENGINEER OF DEVELOPMENT

DRAWN BY: ECH
CHECKED BY: IRG/JAT
FILE: PW RD TS Geo/mdot traf GEO-300-D.dgn REV. 01/20/2010

GEOMETRIC DESIGN GUIDE FOR
DIAMOND INTERCHANGE

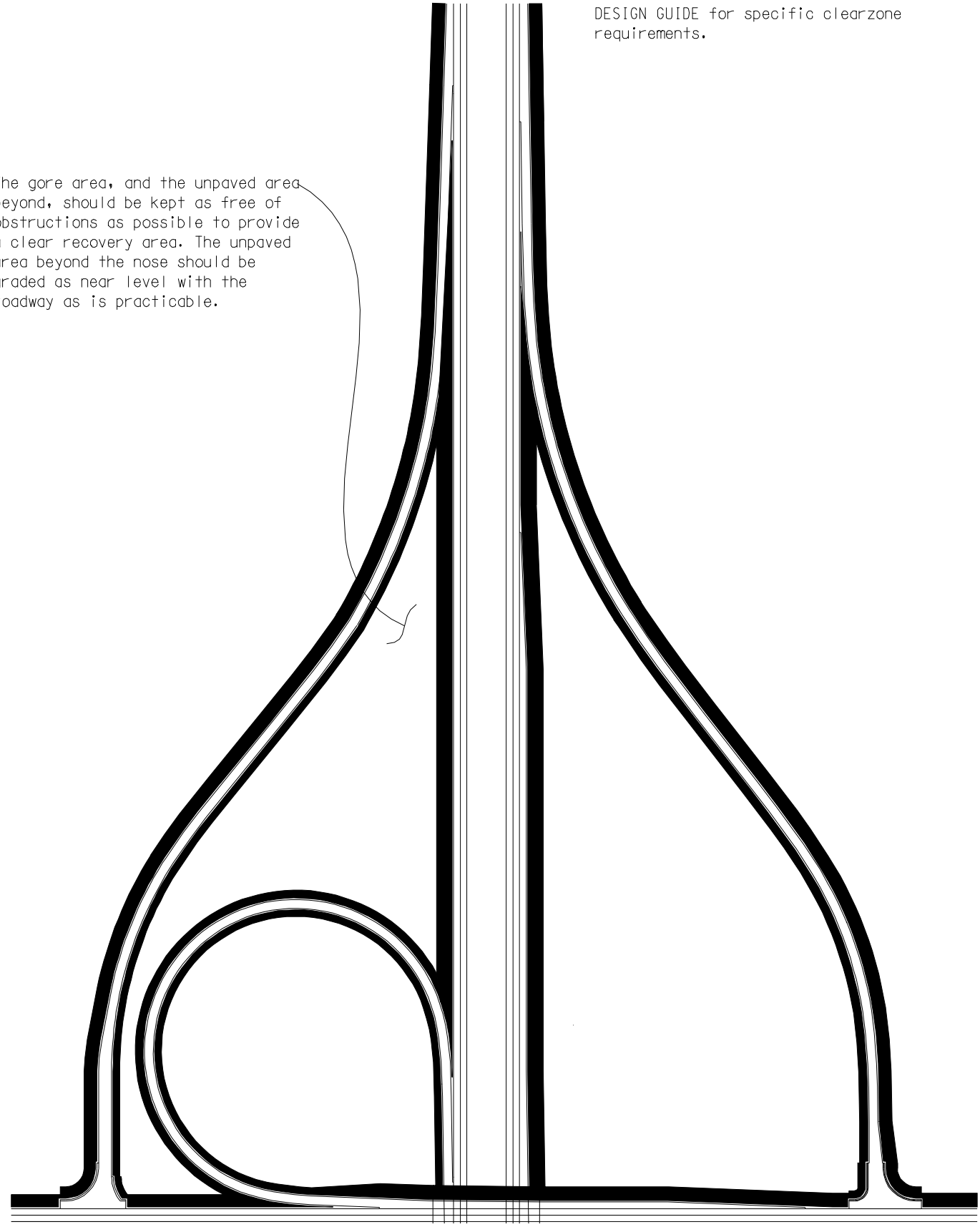
06/03/2010
PLAN DATE:

GEO-300-D

SHEET 1 OF 6

Clear zones are based on variables such as speed, curvature and slope. Since individual site conditions may vary, consult the latest AASHTO ROADSIDE DESIGN GUIDE for specific clearzone requirements.

The gore area, and the unpaved area beyond, should be kept as free of obstructions as possible to provide a clear recovery area. The unpaved area beyond the nose should be graded as near level with the roadway as is practicable.



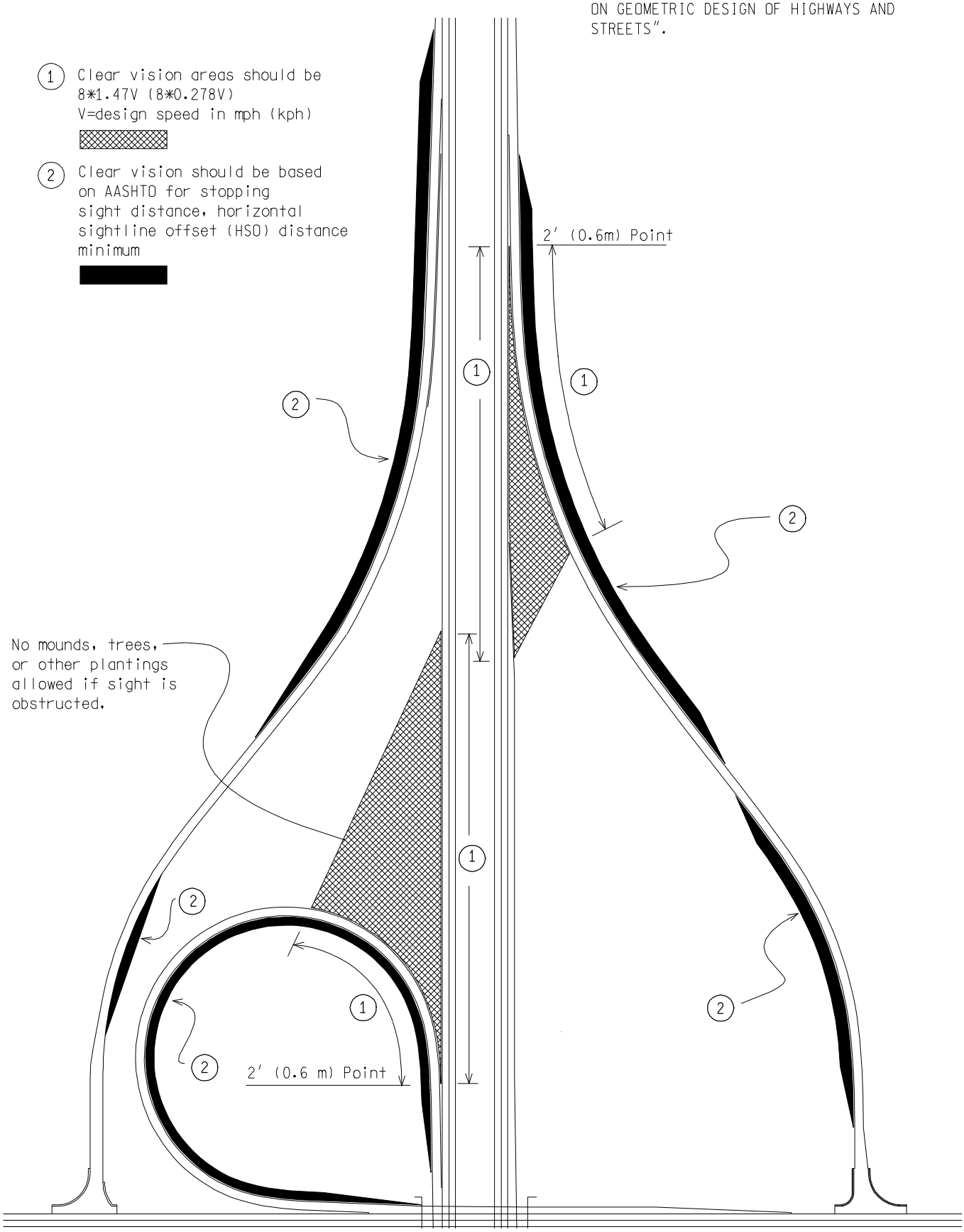
ILLUSTRATIVE GUIDE FOR CLEAR ZONE REQUIREMENTS

NOT TO SCALE

Since individual site conditions may vary, consult "AASHTO A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS".

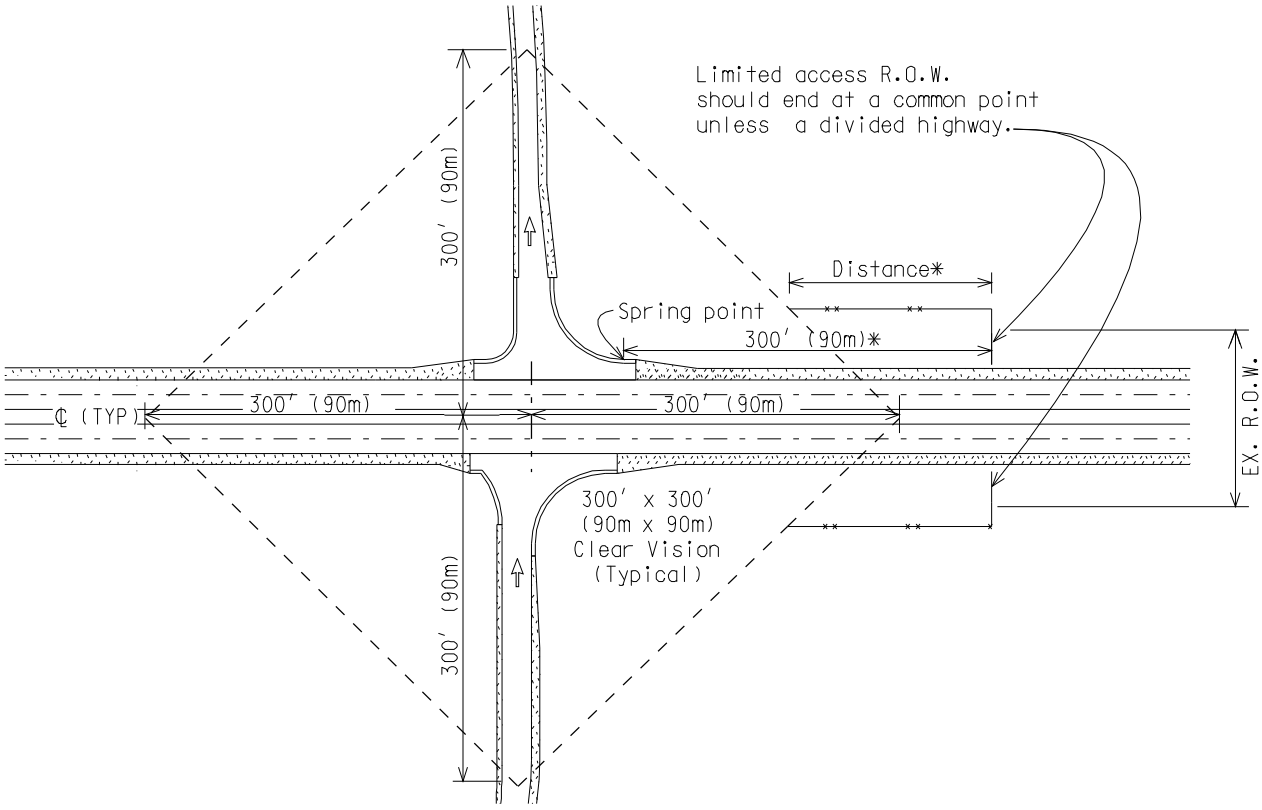
(1) Clear vision areas should be 8*1.47V (8*0.278V) V=design speed in mph (kph)

(2) Clear vision should be based on AASHTO for stopping sight distance, horizontal sightline offset (HSO) distance minimum



ILLUSTRATIVE GUIDE FOR VISION REQUIREMENTS

NOT TO SCALE

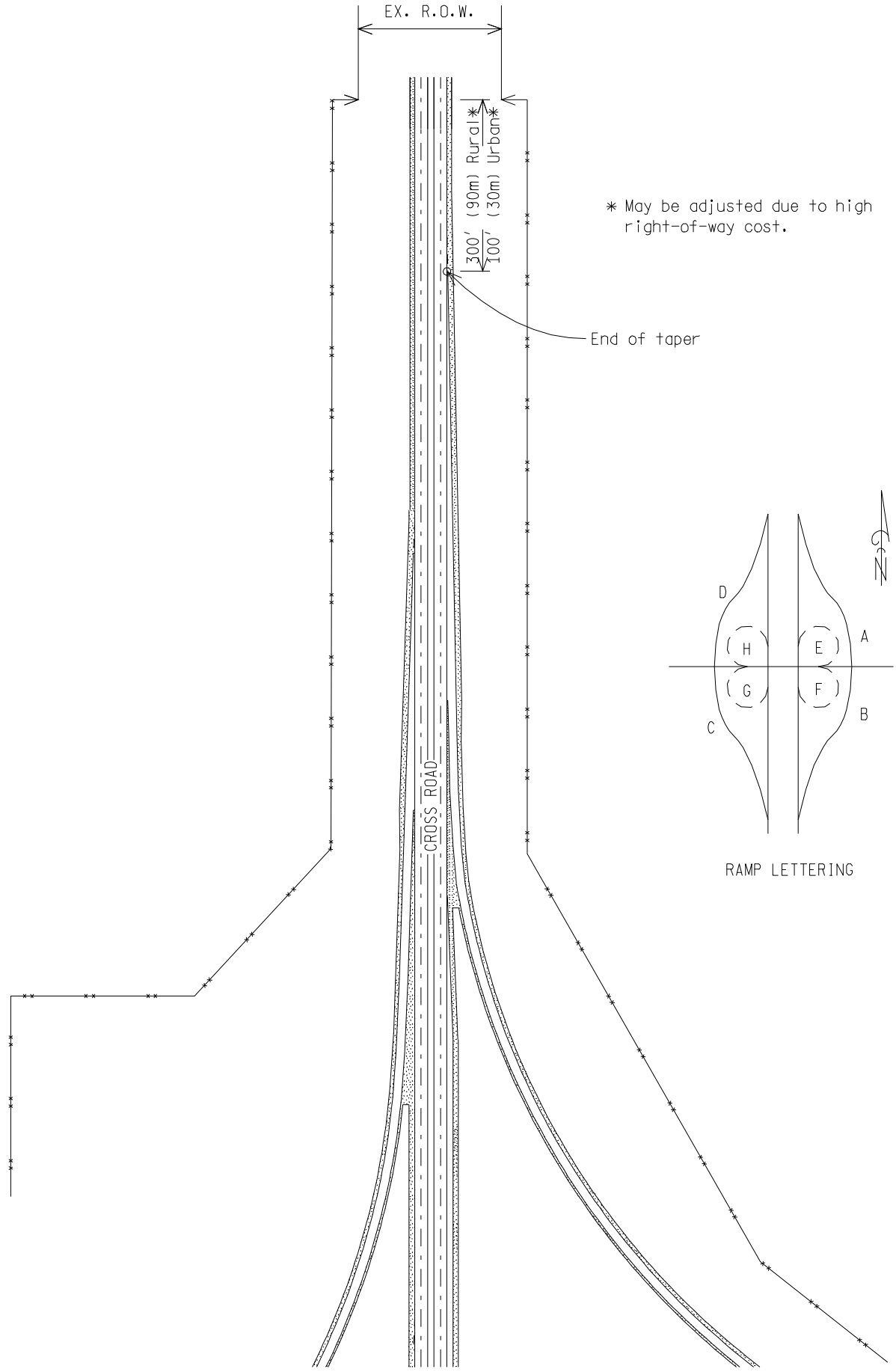


*Limited access right-of-way to the end of the right turn taper or 300' (90m) minimum from the springpoint, if there is no auxiliary lane.

May be adjusted due to high right-of-way cost.

GUIDE FOR LIMITED ACCESS RIGHT-OF-WAY AND CLEAR VISION AREAS AT RAMP TERMINALS (RURAL)

NOT TO SCALE



GUIDE FOR LIMITED ACCESS RIGHT-OF-WAY AT RAMP TERMINALS

NOT TO SCALE

NOTES:

1. Spiral transitions should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series.

2. The cross slope in the gore area between the 2′ (0.6m) point and the 22′ (6.6m) point should not exceed 8% with a 6% maximum algebraic difference in cross slope between the gore and the adjacent lane. This algebraic difference also applies within crowned gores.

3. The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

4. Each ramp should be carefully studied to provide maximum vision at its merge points.

5. See Geometric Design GEO-370-Series for ramp terminal details.

6. The interchange design should allow for possible future construction of a Parclo-A 4 quad design or the need for B-Loops. See GEO-120-Series for successive entrance ramps and GEO-150-Series for successive exit ramps.

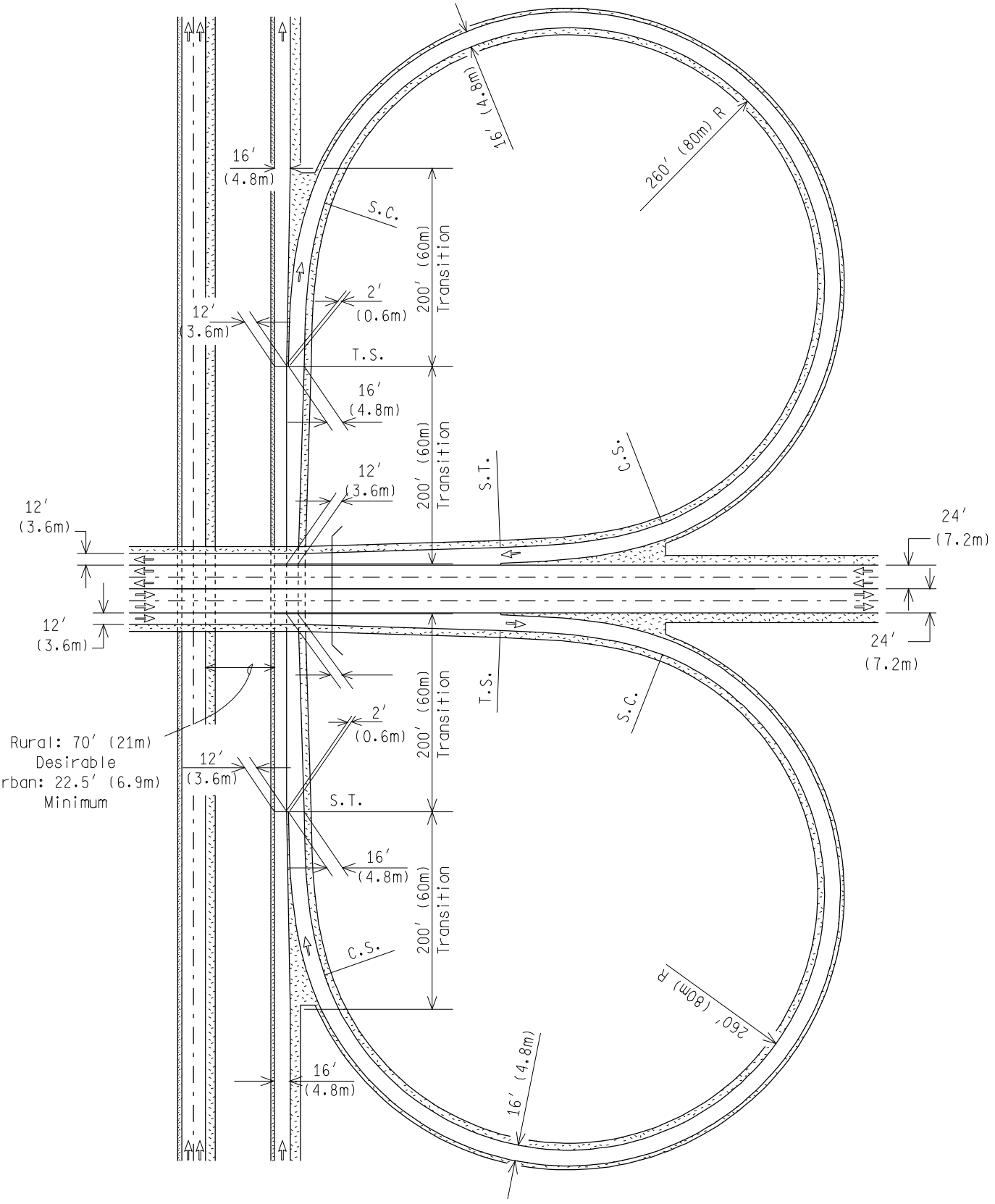
7. See Standard Plan R-42-Series for joint layouts for ramps.

8. Current AASHTO A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS and MDOT Guidelines should be used for sight distance requirements. Local or County roads over freeways should be designed for stopping sight distance based on the project design speed.

9. Limited access Right-of-Way should be as shown in this guide and the current MDOT Road Design Manual.

10. These design concepts are for new construction. Where modifications are needed for retrofitting to existing road features, consult the Geometric Review and Congestion Analysis Unit, Division of Operations.

NOT TO SCALE



NOT TO SCALE

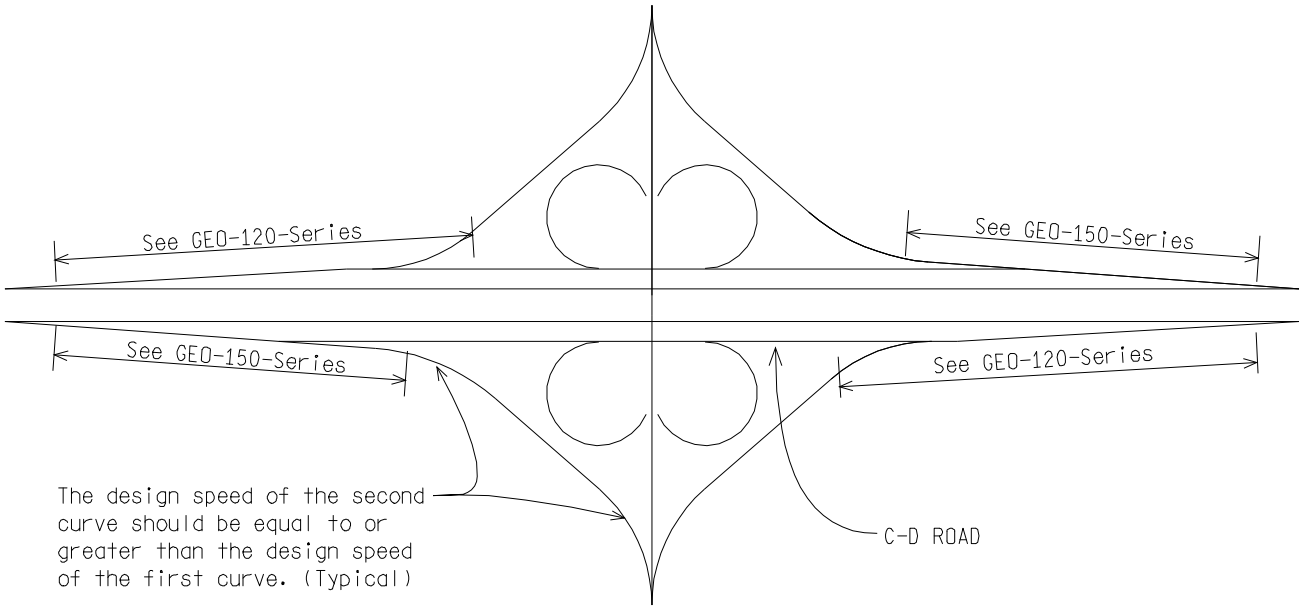
MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

BY: John C Friend
ENGINEER OF DELIVERY

BY: Mark A Van Portfliet
ENGINEER OF DEVELOPMENT

GEOMETRIC DESIGN GUIDE FOR
COLLECTOR-DISTRIBUTOR ROAD

DRAWN BY: ECH			
CHECKED BY: IRG/JAT			
FILE: PW RD TS Geo/mdot traf GEO-310-C.dgn REV. 01/20/2010	06/03/2010 PLAN DATE:	GEO-310-C	SHEET 1 OF 2



NOTES:

1. A collector-distributor (C-D) roadway should be considered on all freeway mainlines that require the use of two adjacent loops.

2. The collector-distributor (C-D) roadway is generally designed with a 60 mph (100 kmph) design speed.

3. The design speed of the vertical alignment should meet or exceed the design speed of the horizontal alignment.

4. Spirals should be used on new alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series.

5. Loop Ramps shall have a 7% superelevation. On flatter curves, superelevation should meet Standard Plan R-107-Series, but may be increased to 7% to increase the design speed of the turning roadway.

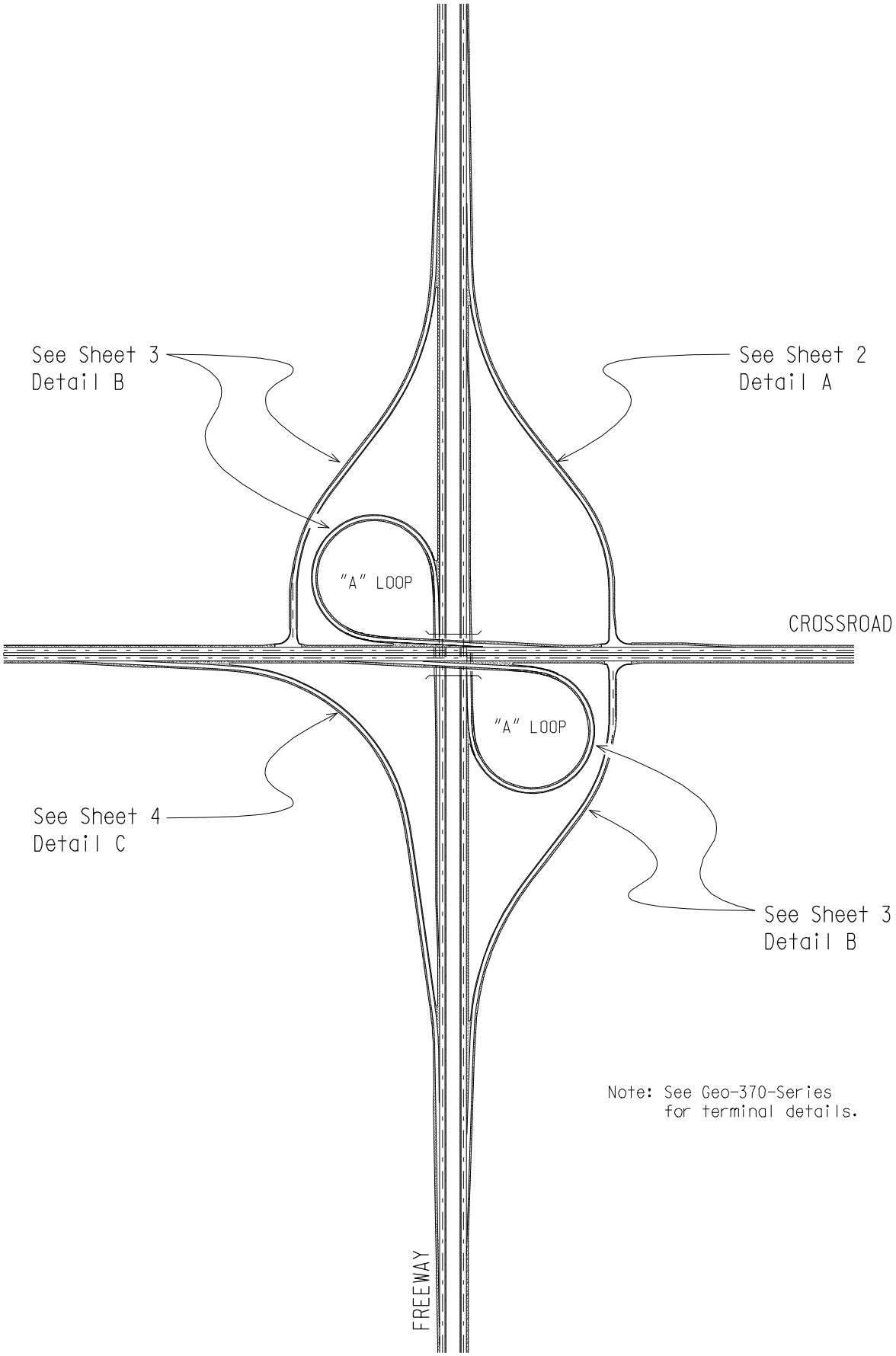
6. Each ramp should be carefully studied to provide maximum vision at its merge points. See Geometric Design Guide GEO-300-Series.

7. See GEO-300-Series for clear vision and limited access right-of-way requirements.

8. Current AASHTO "A Policy on Geometric Design and Highways and Streets" and MDOT Guidelines should be used for sight distance requirements. Local or County roads over freeways should be designed for stopping sight distance based on the project design speed.

9. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Review and Congestion Analysis Unit, Division of Operations.

NOT TO SCALE



Note: See Geo-370-Series
for terminal details.

NOT TO SCALE

MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

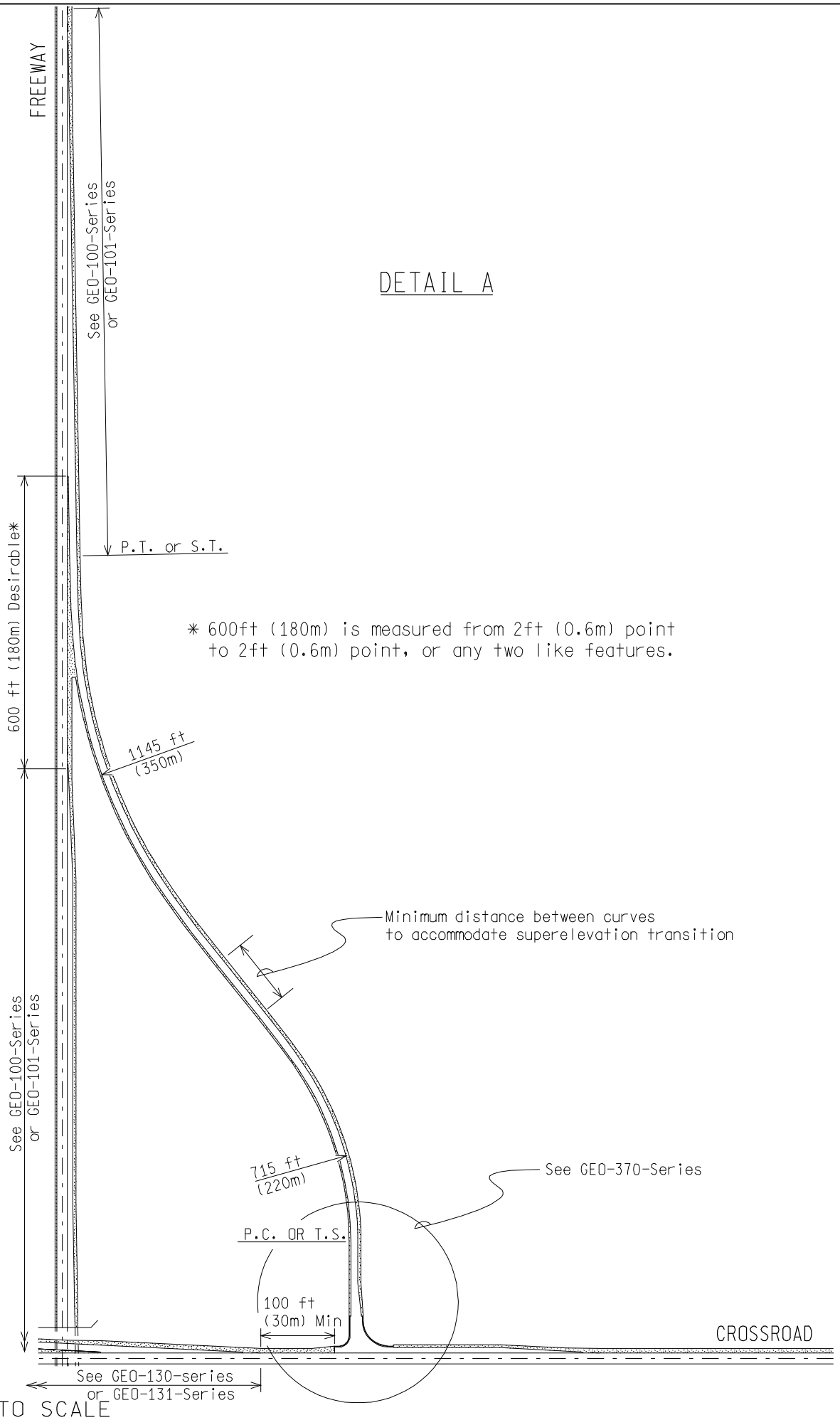
BY: John C. Friend
ENGINEER OF DELIVERY

BY: Jol S. Pobst
ENGINEER OF DEVELOPMENT

GEOMETRIC DESIGN GUIDE FOR

PARCLO-A-4-QUAD

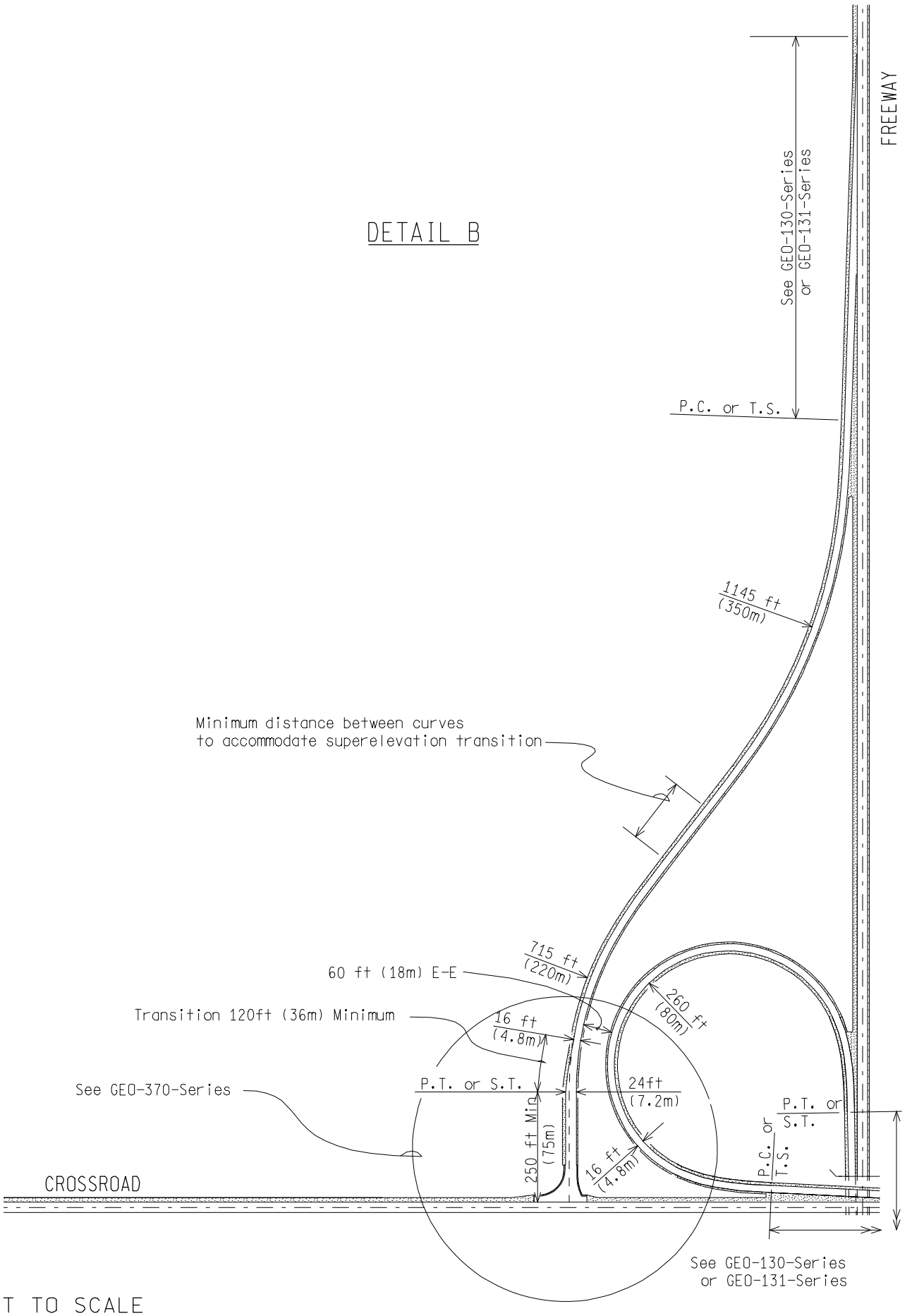
DRAWN BY: DJF			
CHECKED BY: IRG/JAT	08/07/2008 PLAN DATE:	GEO-320-C	SHEET 1 OF 5
FILE:PW:RD/T&S/Typicals/Geom D/GEO320C.dgn REV. 09/22/2008 JK			



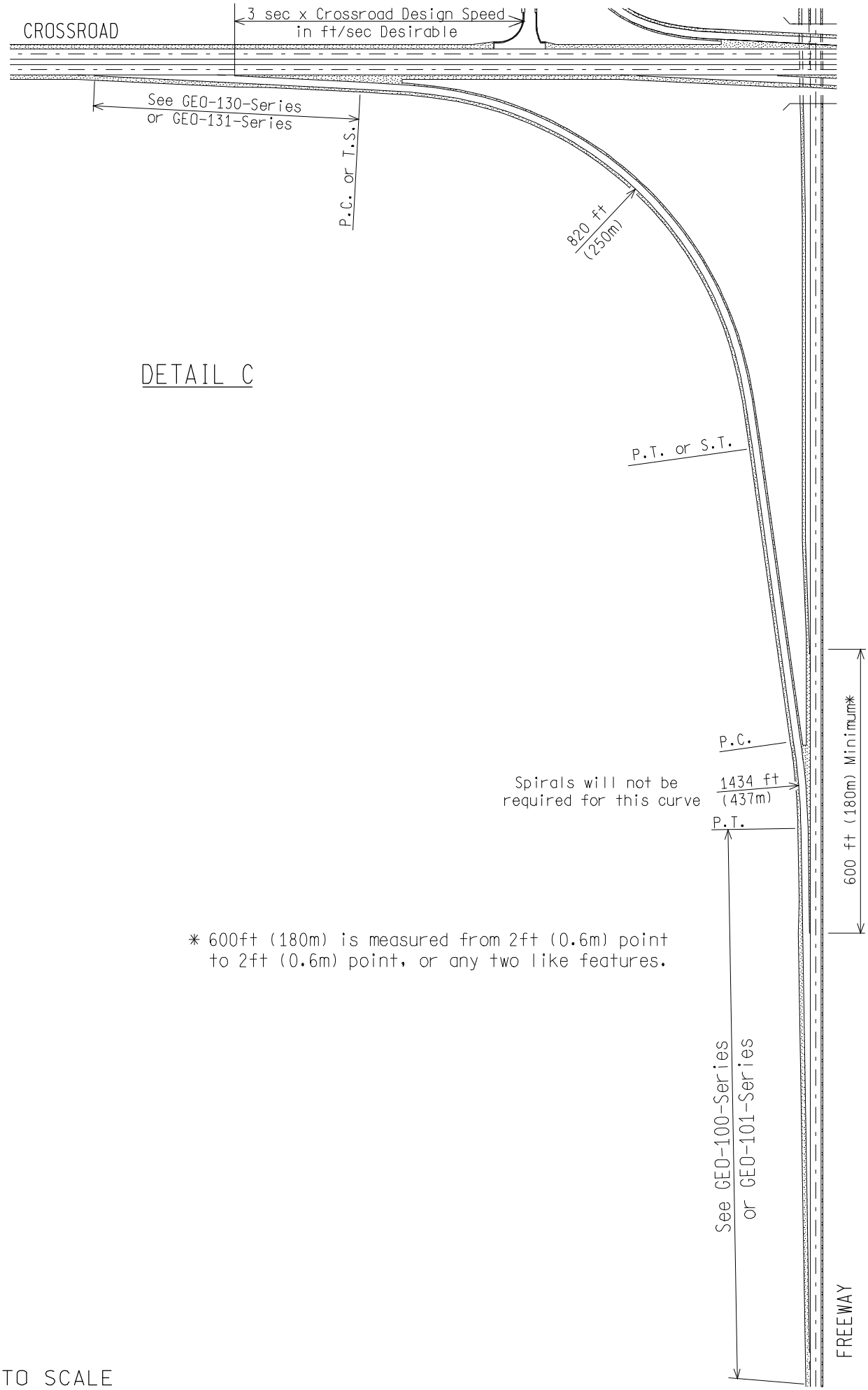
DETAIL A

* 600ft (180m) is measured from 2ft (0.6m) point to 2ft (0.6m) point, or any two like features.

NOT TO SCALE


DETAIL B
FREEWAY
See GEO-130-Series
or GEO-131-Series
P.C. or T.S.
1145 ft
(350m)
Minimum distance between curves
to accommodate superelevation transition
715 ft
(220m)
60 ft (18m) E-E
Transition 120ft (36m) Minimum
16 ft
(4.8m)
260 ft
(80m)
See GEO-370-Series
P.T. or S.T.
24ft
(7.2m)
250 ft Min
(75m)
16 ft
(4.8m)
P.T. or
S.T.
P.C. or
T.S.
See GEO-100-Series
or GEO-101-Series
CROSSROAD
See GEO-130-Series
or GEO-131-Series

NOT TO SCALE



* 600ft (180m) is measured from 2ft (0.6m) point to 2ft (0.6m) point, or any two like features.

NOT TO SCALE

NOTES:

1. This Geometric Design Guide is applicable where physical restrictions or lack of R.O.W. prohibit usage of a full Cloverleaf design.

2. This layout is applicable for crossroad passing over or under the freeway.

3. A free-flow ramp from the crossroad to the freeway is preferred in place of a diamond ramp provided the greater required length of limited access along the crossroad can be met.

4. Spiral transitions should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. This table gives the maximum radius in which a spiral should be used.

5. The cross slope in the gore area between the 2 ft (0.6m) point and the 22 ft (6.6 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope between the gore and the adjacent lane. This algebraic difference also applies within crowned gores.

6. The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

7. For allowable approach grades between the cross road and ramp terminal, see GEO-650-Series.

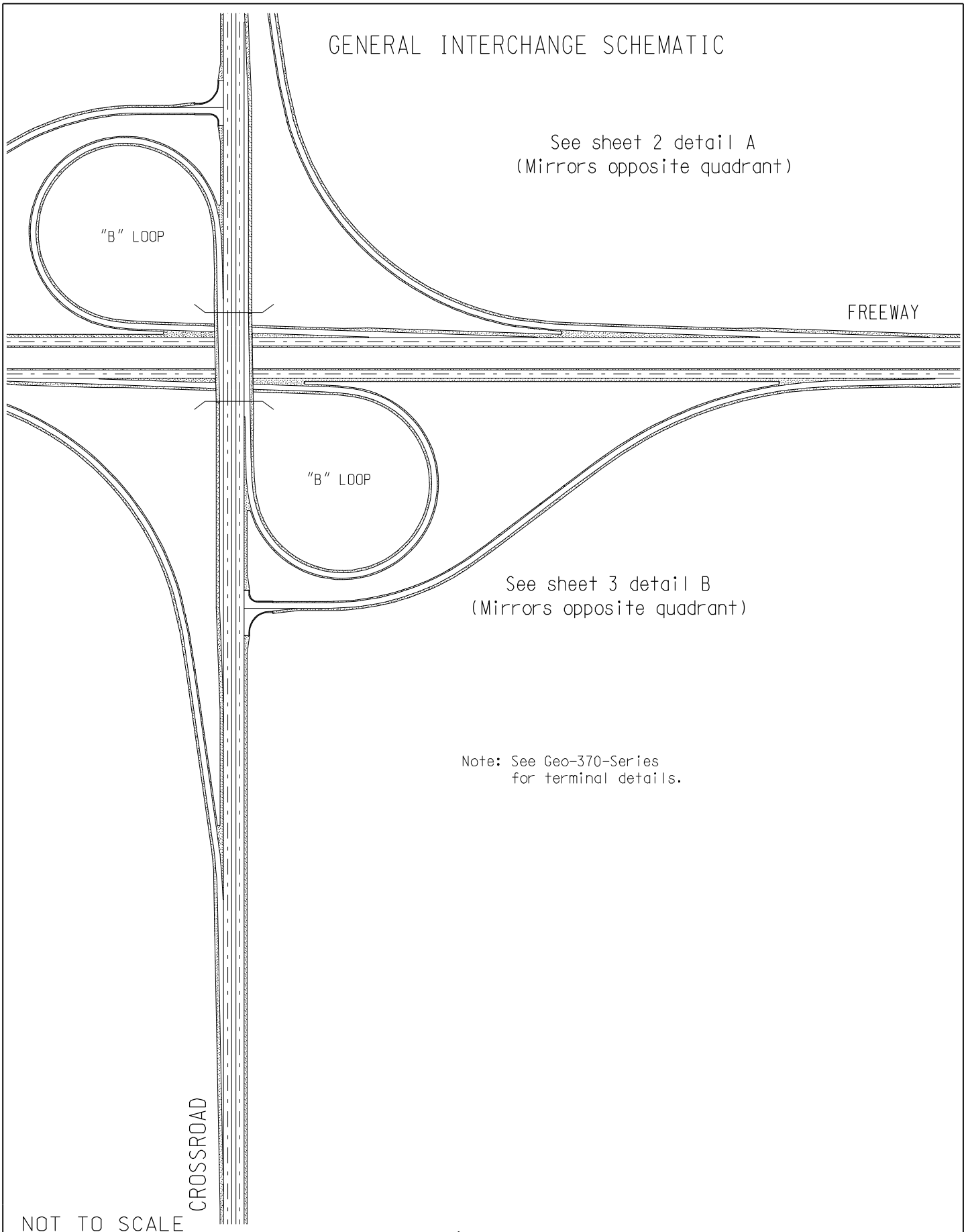
8. See Geometric Design Guide GEO-370-Series for ramp terminal details.

9. See Geometric Design Guide GEO-300-Series for clear vission area requirements.

10. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE

GENERAL INTERCHANGE SCHEMATIC



Note: See Geo-370-Series
for terminal details.

NOT TO SCALE

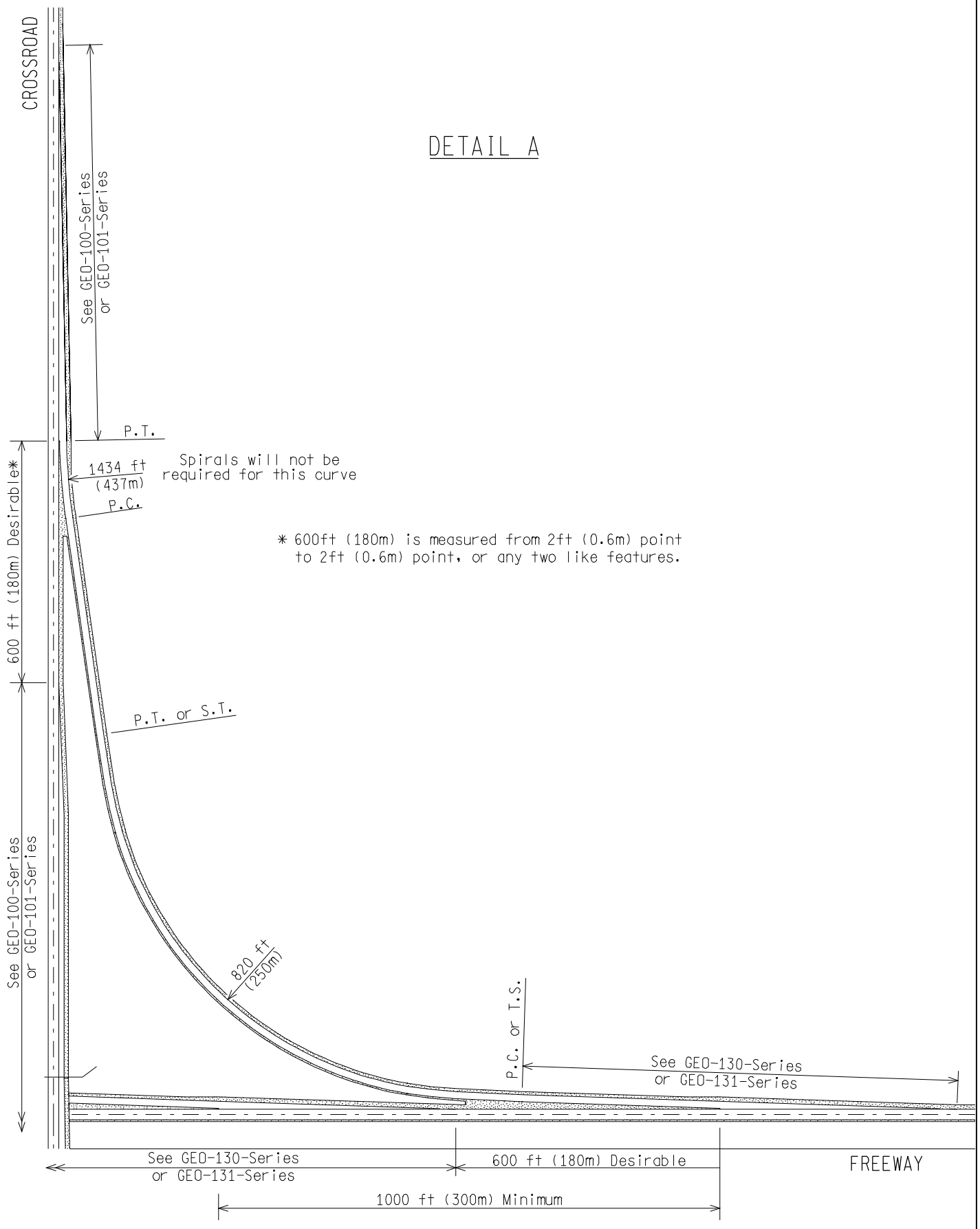
MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

BY: John C Friend
ENGINEER OF DELIVERY

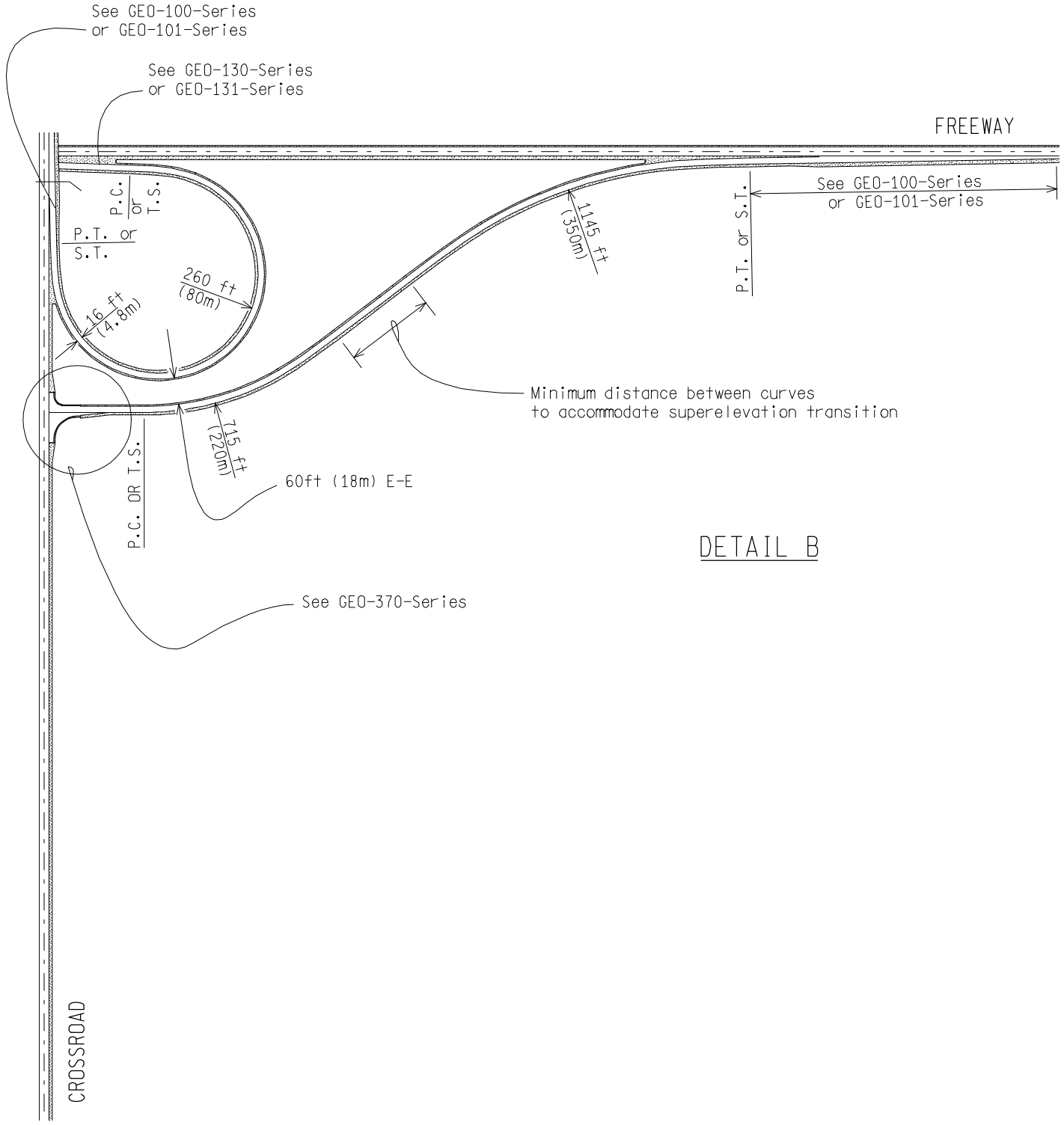
BY: Joel S. Pollard
ENGINEER OF DEVELOPMENT

GEOMETRIC DESIGN GUIDE FOR
PARCLO-B-4-QUAD

DRAWN BY: DJF			
CHECKED BY: IRG/JAT			
FILE:PW:RD/T&S/Typicals/Geom D/GEO330C.dgn REV. 09/22/2008 JK	08/07/2008 PLAN DATE:	GEO-330-C	SHEET 1 OF 4


CROSSROAD
DETAIL A
See GEO-100-Series
or GEO-101-Series
P.T.
1434 ft
(437m)
Spirals will not be
required for this curve
P.C.
* 600ft (180m) is measured from 2ft (0.6m) point
to 2ft (0.6m) point, or any two like features.
600 ft (180m) Desirable*
P.T. or S.T.
See GEO-100-Series
or GEO-101-Series
820 ft
(250m)
P.C. or T.S.
See GEO-130-Series
or GEO-131-Series
See GEO-130-Series
or GEO-131-Series
600 ft (180m) Desirable
FREEWAY
1000 ft (300m) Minimum

NOT TO SCALE



DETAIL B

NOT TO SCALE

NOTES:

1. This Geometric Design Guide is applicable where physical restrictions or lack of R.O.W. prohibit usage of a full Cloverleaf design.

2. This layout is applicable for crossroad passing over or under the freeway.

3. Spiral transitions should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. This table gives the maximum radius in which a spiral should be used.

4. The cross slope in the gore area between the 2 ft (0.6m) point and the 22 ft (6.6 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope between the gore and the adjacent lane. This algebraic difference also applies within crowned gores.

5. The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

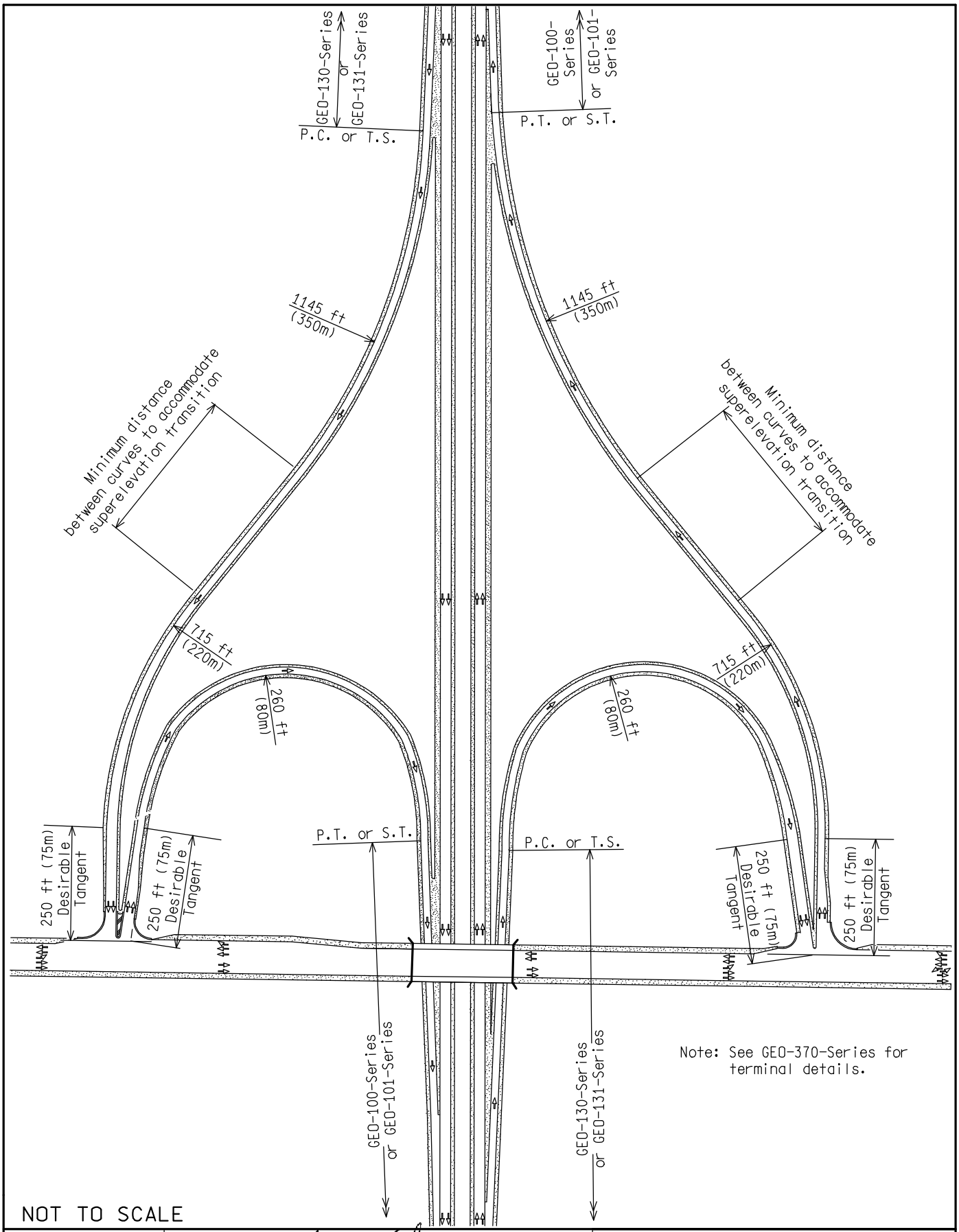
6. For allowable approach grades between the cross road and ramp terminal, see GEO-650-Series.

7. See Geometric Design Guide GEO-370-Series for ramp terminal details.

8. See Geometric Design Guide GEO-300-Series for clear vision requirements.

9. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE



Note: See GEO-370-Series for terminal details.

NOT TO SCALE

MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

BY: John C Friend
ENGINEER OF DELIVERY

BY:
ENGINEER OF DEVELOPMENT

DRAWN BY: DJF
CHECKED BY: IRG/JAT
FILE: PW/RD/TS/Geom D/mdot GEO340A EOC.dgn REV. 09/06/2007

GEOMETRIC DESIGN GUIDE FOR
PARCLO A-B-2-QUAD

09/06/2007
PLAN DATE:

GEO-340-A

SHEET 1 OF 2

NOTES:

1) This geometric design guide is applicable where physical restrictions or a lack of R.O.W prohibit usage of a full cloverleaf design.

2) This layout is applicable for the crossroad passing over or under the freeway.

3) Spiral transitions should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. This table gives the maximum radius in which a spiral should be used.

4) The cross slope in the gore area between the 2 ft (0.6 m) point and 22 ft (6.6 m) point should not exceed 8%, with a 6% maximum algebraic difference in cross slope between the gore and the adjacent lane. This algebraic difference also applies within crowned gores.

5) The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

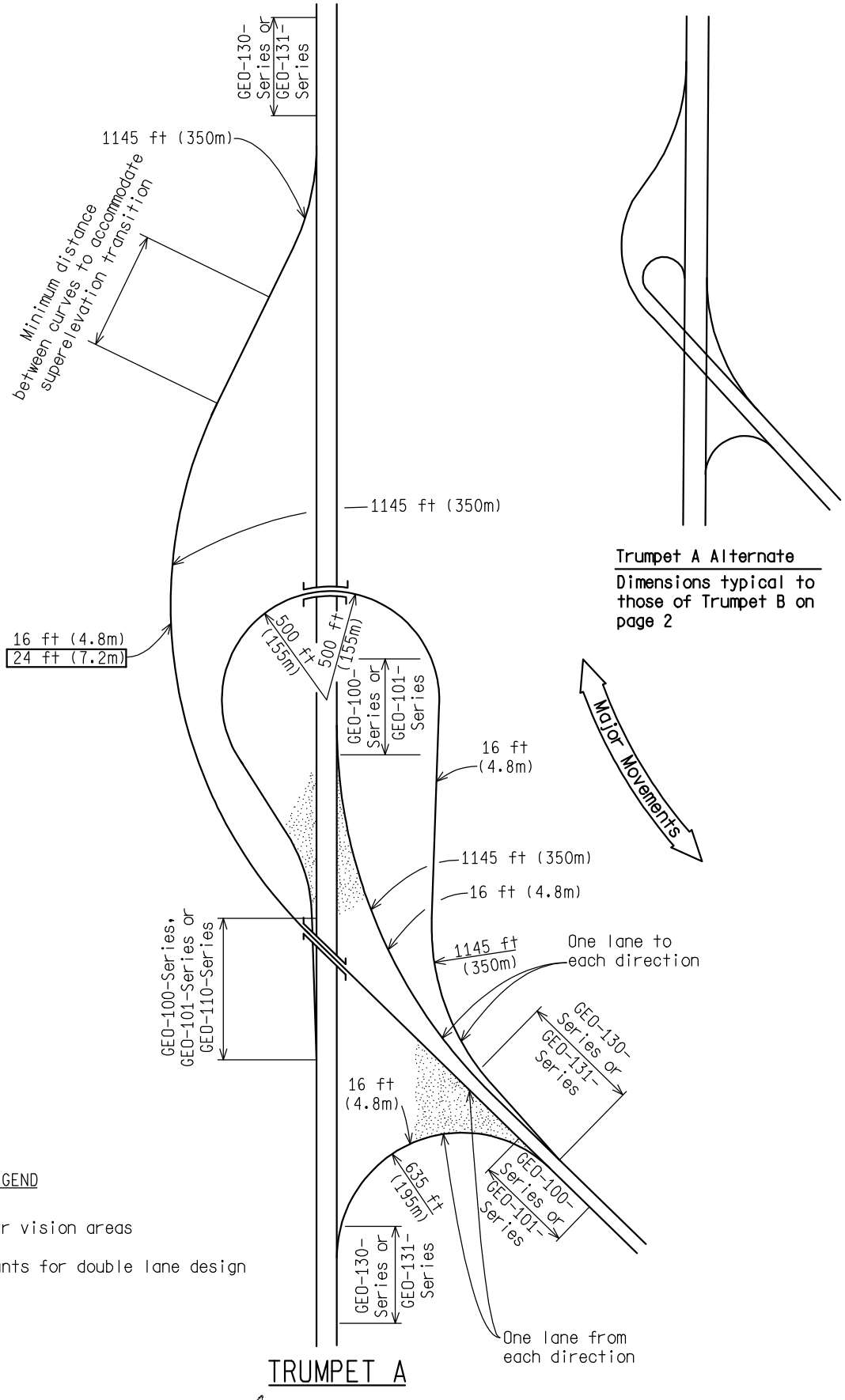
6) For allowable approach grades between the crossroad and ramp terminal, see GEO-650-Series.

7) See geometric design guide GEO-370-Series for ramp terminal details.

8) See geometric design guide GEO-300-Series for clear vision area requirements.

9) These design concepts are for new construction. Where modifications may be needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE



Trumpet A Alternate

Dimensions typical to those of Trumpet B on page 2

TRUMPET A

NOT TO SCALE

MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

DRAWN BY: DJF
CHECKED BY: IRG/JAT
FILE: PW/RD/TS/Geom D/mdot GEO350B EOC.dgn

BY: John C. Friend
ENGINEER OF DELIVERY

BY:
ENGINEER OF DEVELOPMENT

REV. 09/06/2007

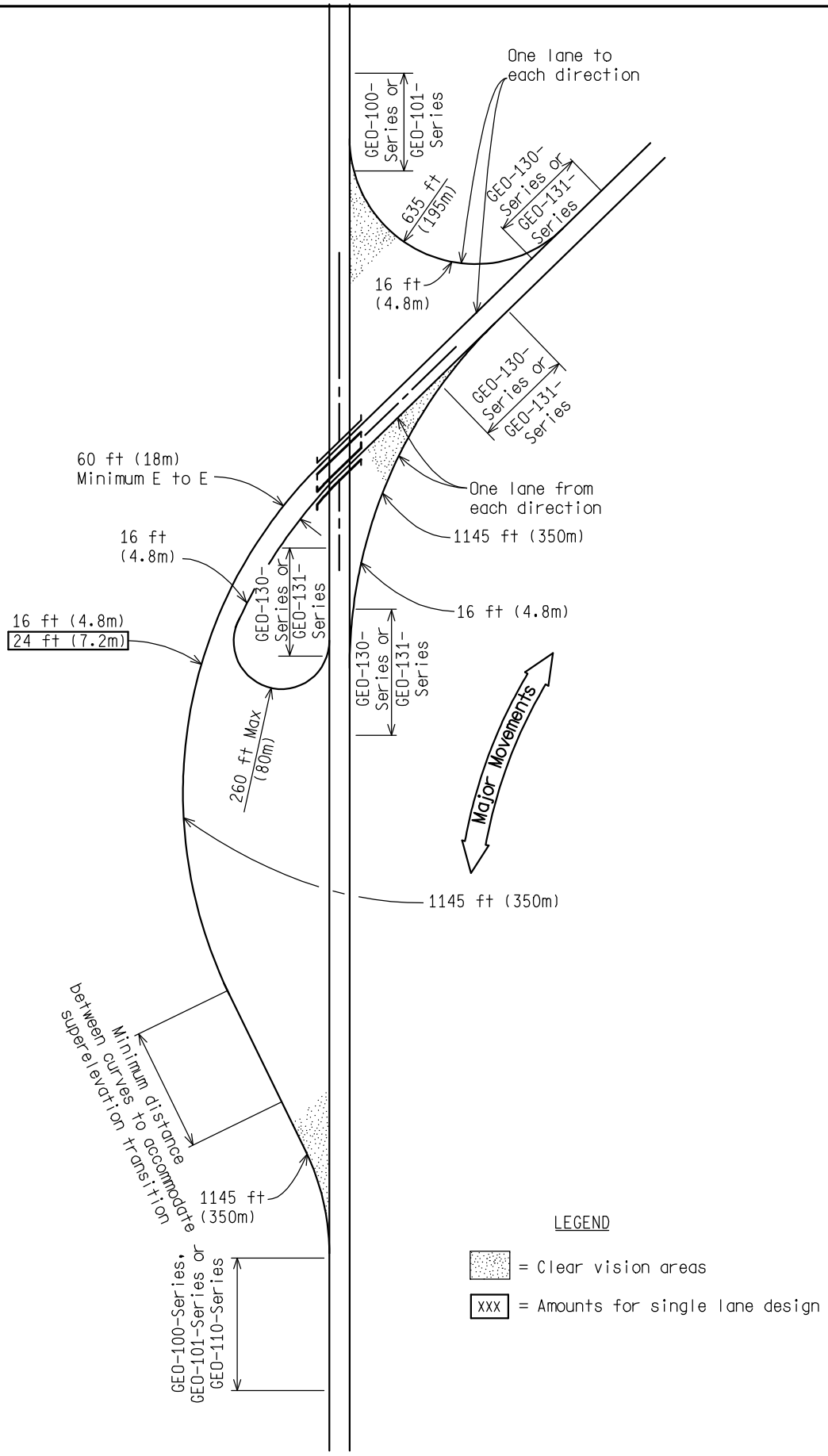
GEOMETRIC DESIGN GUIDE FOR

TRUMPET TYPE INTERCHANGE

09/06/2007
PLAN DATE:

GEO-350-B

SHEET 1 OF 3



TRUMPET B

NOT TO SCALE

NOTES:

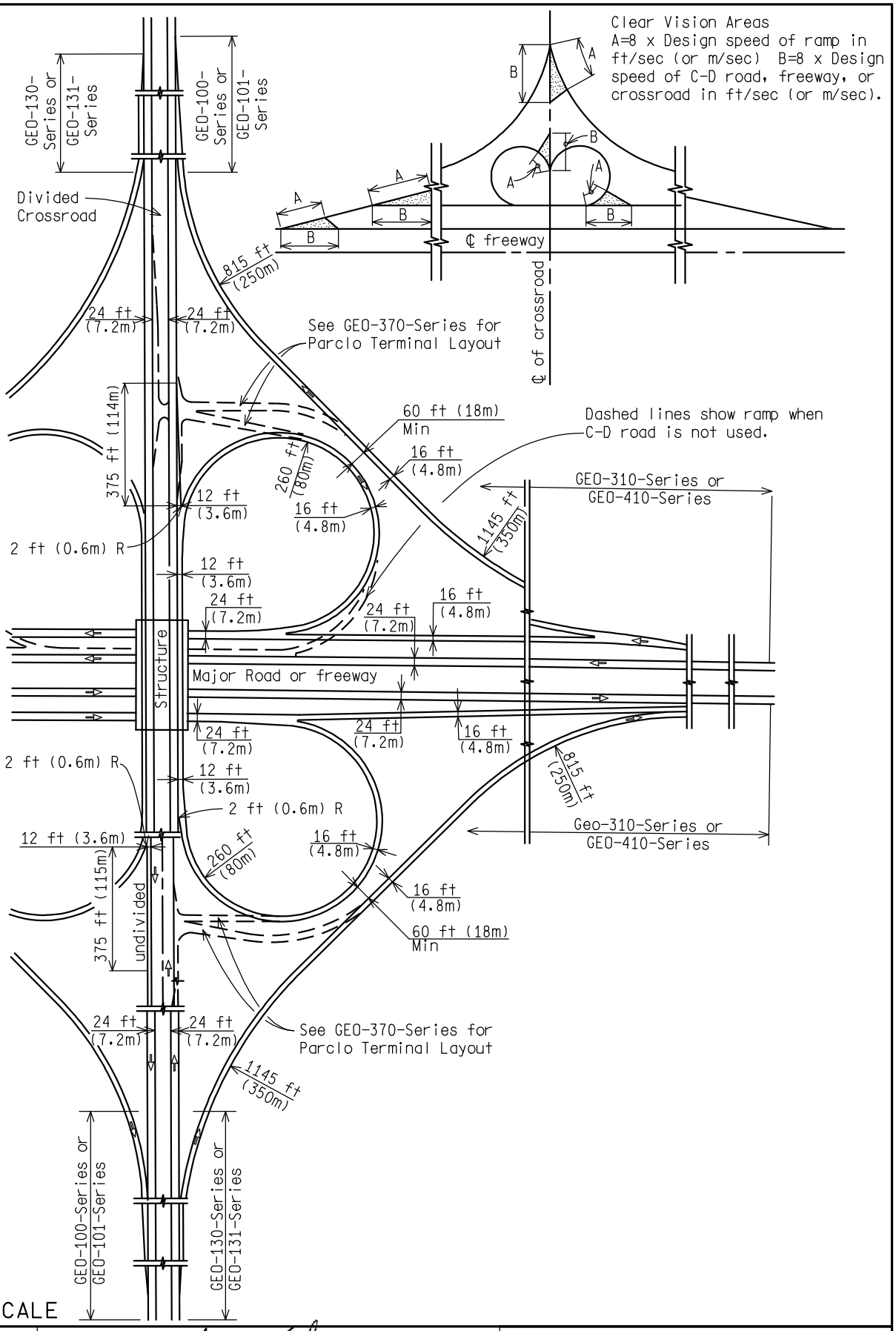
1) For ramps longer than 2000 ft (610m) consider two lanes to allow for passing opportunities.

2) Spiral transitions should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. The table gives the maximum radius in which a spiral should be used.

3) See geometric design guide GEO-300-Series for clear vision area requirements.

4) These design concepts are for new construction. Where modifications may be needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE



MDOT Michigan Department of Transportation TRAFFIC AND SAFETY	BY: John C. Friend ENGINEER OF DELIVERY	GEOMETRIC DESIGN GUIDE FOR CLOVERLEAF TYPE INTERCHANGE
DRAWN BY: DJF CHECKED BY: IRG/JAT	BY: Jon S. Pollard ENGINEER OF DEVELOPMENT	09/06/2007 PLAN DATE: | GEO-360-A | SHEET 1 OF 2
FILE: PW/RD/TS/Geom D/mdot GEO360A EOC.dgn	REV. 09/06/2007	

NOTES:

1) The design speed of the collector-distributor (C-D) roadway is generally 60 mph (100 km/hr).

2) Spiral transitions should be used on new ramp alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series. The table gives the maximum radius in which a spiral should be used.

3) The cross slope in the gore area between the 2 ft (0.6 m) point and the 22 ft (6.6 m) point should not exceed 8% with a 6% maximum algebraic difference in cross slope between the gore and the adjacent lane. This algebraic difference also applies within crowned gores.

4) The design speed of the ramp vertical alignment should meet or exceed the design speed of the ramp horizontal alignment.

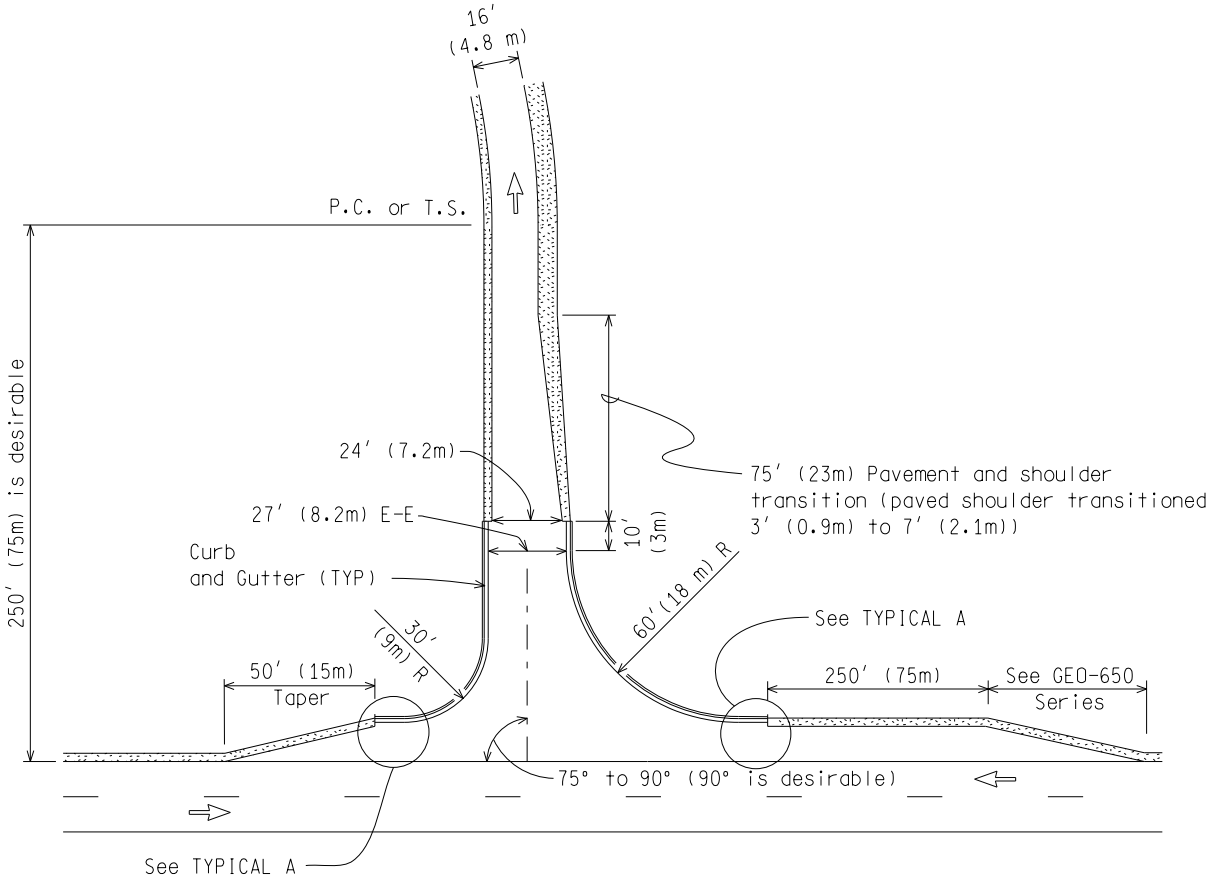
5) Each ramp should be carefully studied to provide maximum vision at its merge points. See Geometric Design Guide GEO-300-Series.

6) See Geometric Design Guide GEO-370-Series for ramp terminal details.

7) The longitudinal joint on a 24 foot (7.2 m) ramp pavement shall be located 12 feet (3.6 m) from the right edge of the pavement and ended where the ramp width becomes 16 feet (4.8m).

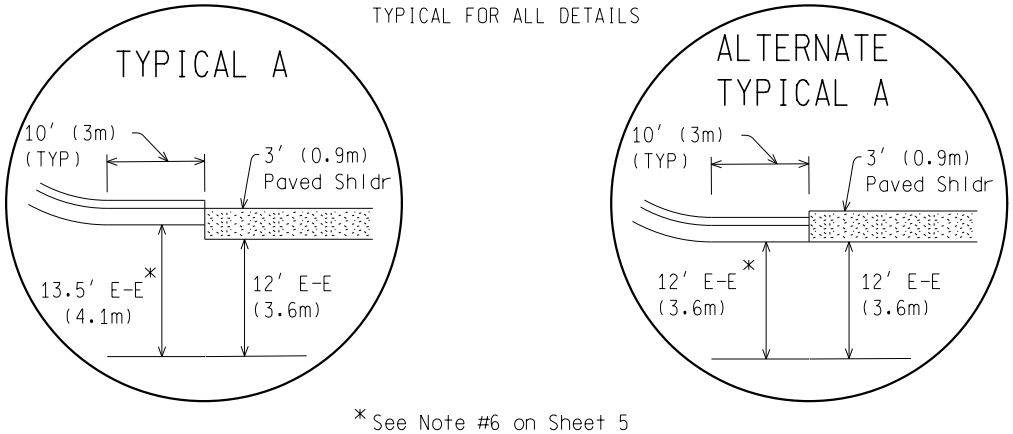
8) These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE



DETAIL 1
RAMP ENTRANCE

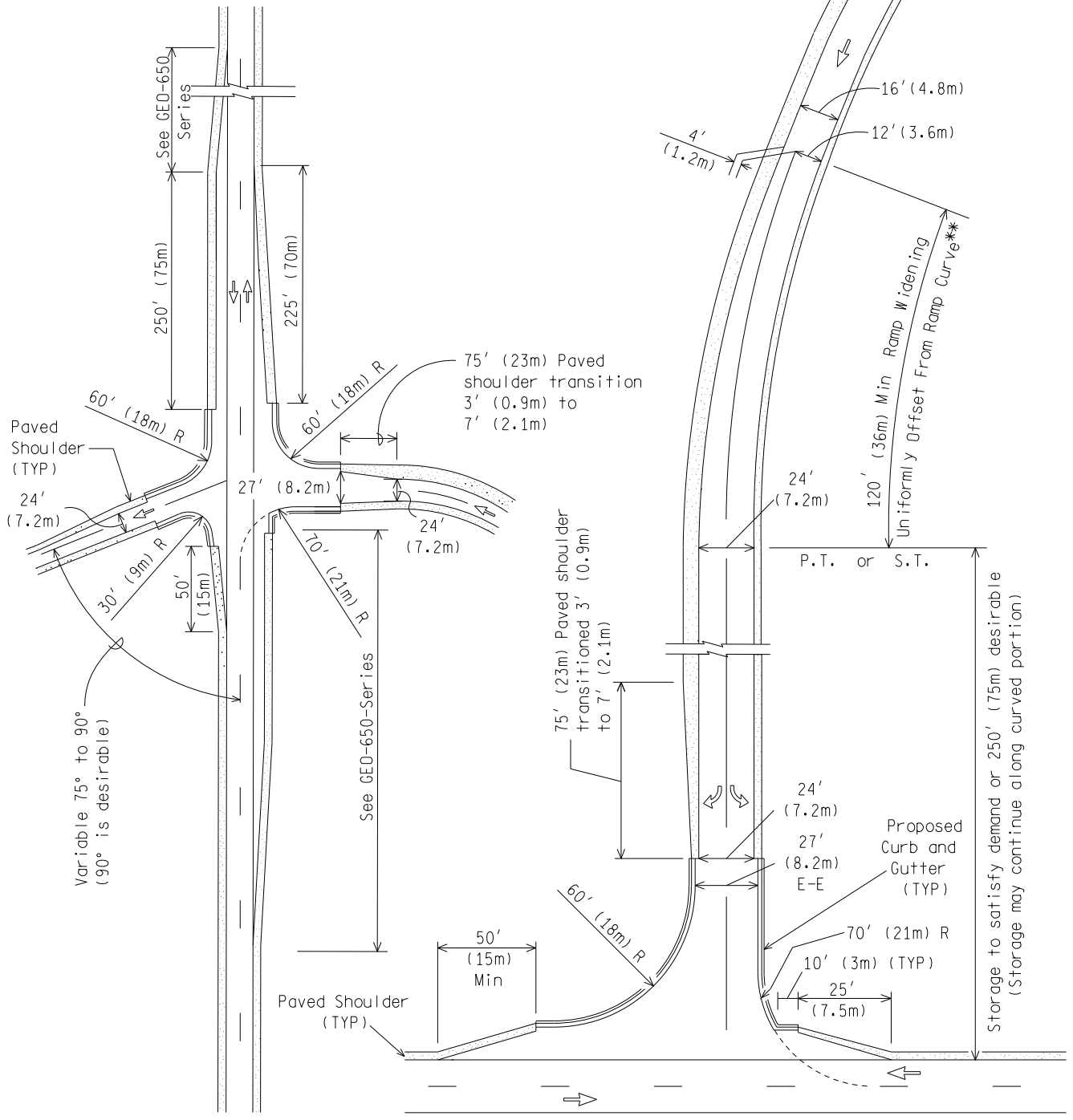
CURB RETURN OFFSET DETAILS
TYPICAL FOR ALL DETAILS



*See Note #6 on Sheet 5

NOT TO SCALE

MDOT Michigan Department of Transportation TRAFFIC AND SAFETY		GEOMETRIC DESIGN GUIDE FOR RAMP TERMINAL DETAILS
DRAWN BY: DFK CHECKED BY: IG & JAT FILE:PW RD TR Typ Final Geo/mdot traffic GEO-370-E.dgn REV. 08/02/2016		03/13/2015 PLAN DATE: | GEO-370-E | SHEET 1 OF 5

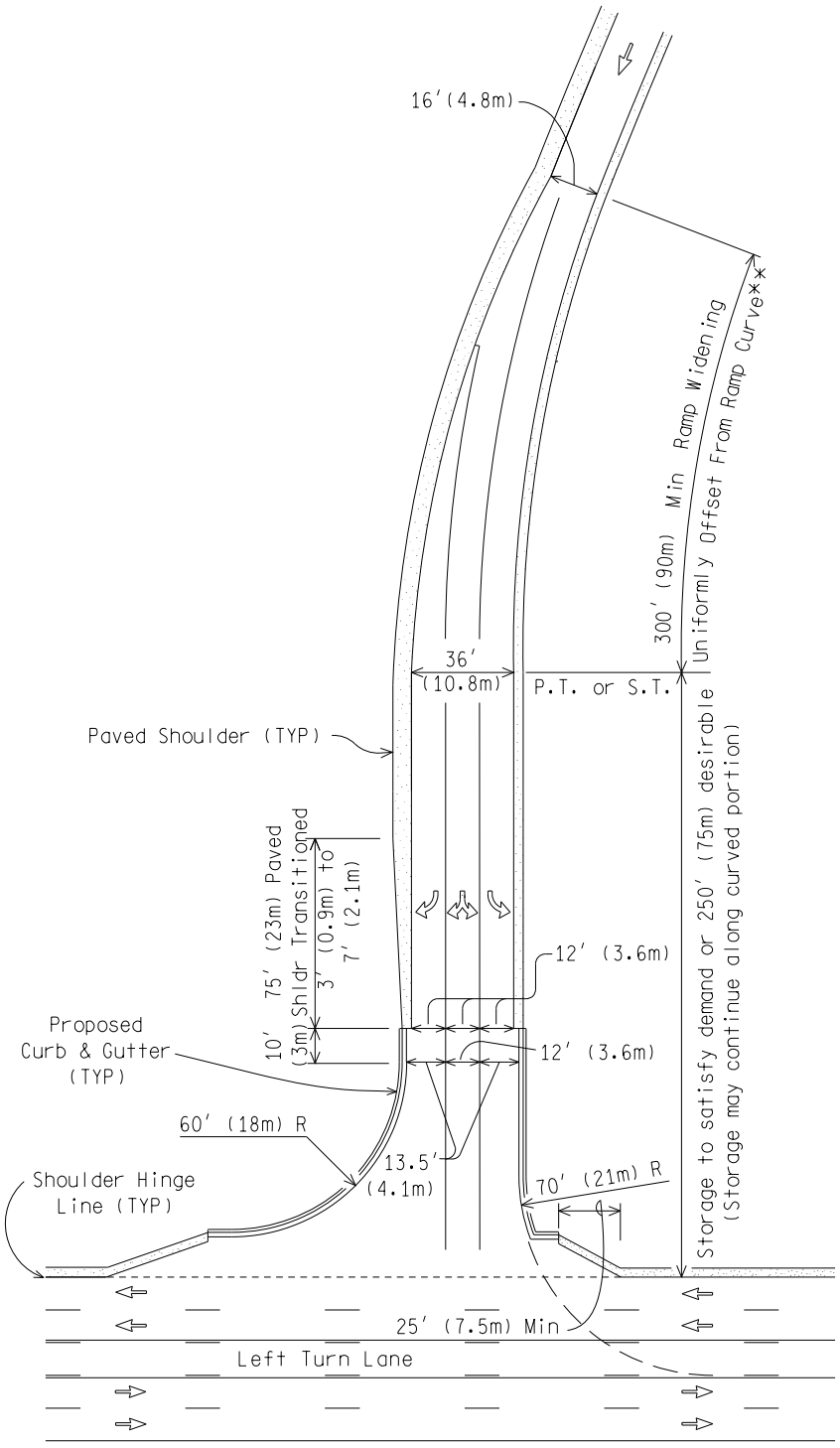


DETAIL 2
ENTRANCE RAMP TERMINAL DESIGN
(Directional Passing Flare)

DETAIL 3
TWO LANE RAMP TERMINAL

** Widening for additional lane(s) should occur on the outside of the ramp (furthest from the mainline freeway). When it is not desirable to add lane(s) to the outside of the ramp, The desired widening should be clearly shown on the plans. See Standard Plan R-42-Series.

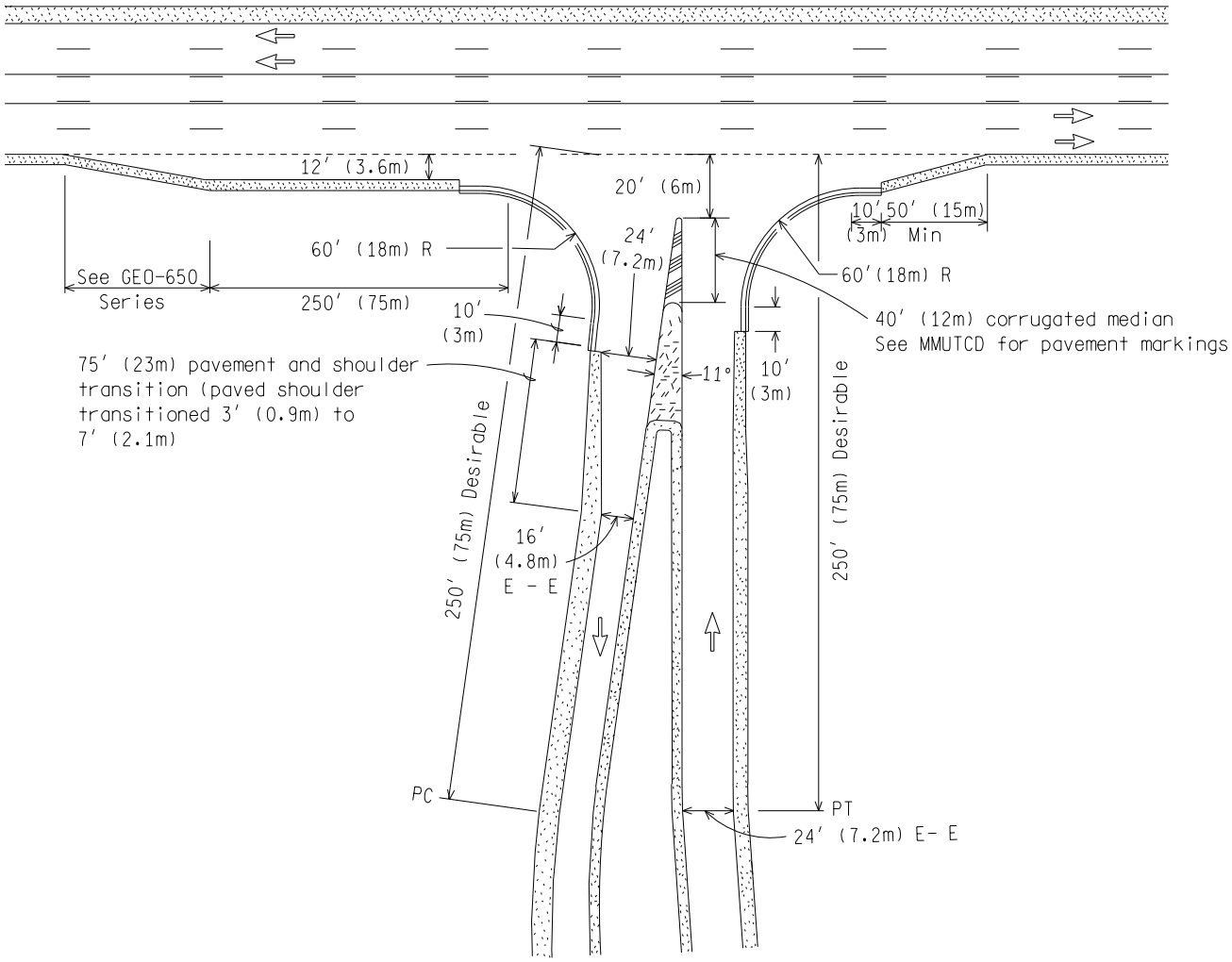
NOT TO SCALE



DETAIL 4
THREE LANE RAMP TERMINAL

** Widening for additional lane(s) should occur on the outside of the ramp (furthest from the mainline freeway). When it is not desirable to add lane(s) to the outside of the ramp, The desired widening should be clearly shown on the plans. See also Standard Plan R-42-Series.

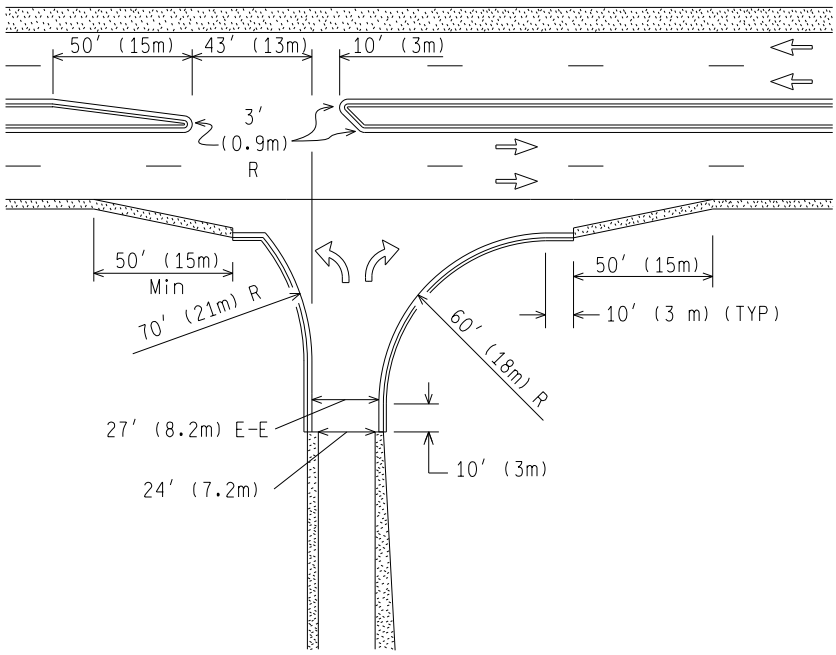
NOT TO SCALE



DETAIL 5

PARCLO ENTRANCE AND EXIT TERMINAL

NOT TO SCALE



DETAIL 6

CURBED MEDIAN DETAIL

NOTES:

1. The dimensions used on this Geometric Design Guide are typical.

2. Where feasible, joint line and lane line markings shall coincide.

3. See Standard Plan R-42-Series for joint layout.

4. Clear vision areas and sight distance along the ramp and its terminals must be according to current MDOT practice. No hidden ramp or disappearing crossroad grades will be permitted.

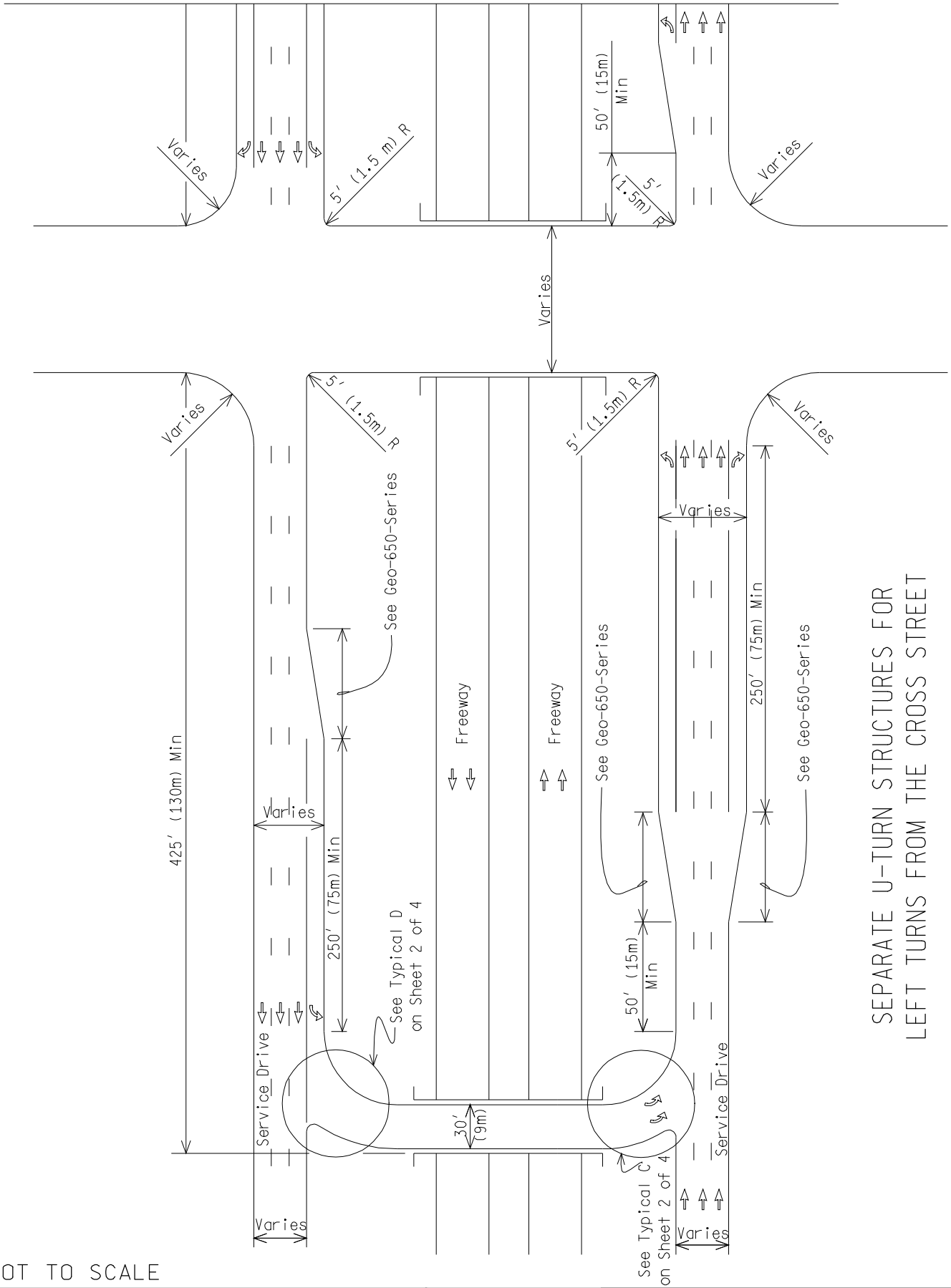
5. Provide intersection sight distance at all exit ramp terminals.

6. Alternate Typical A may be used when construction and maintenance issues make the 13.5' (4.1m) curb setback undesirable or the crossroad is curbed.

7. For all entrance and exit ramps, the angle of intersection between the ramp and the cross-road should be between 75° and 105° (with 90° desirable).

8. All ramp turning radii should be designed to accommodate a WB-67 design vehicle.

NOT TO SCALE



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MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

BY: John C Friend
ENGINEER OF DELIVERY

BY: Mark A Van Portfliet
ENGINEER OF DEVELOPMENT

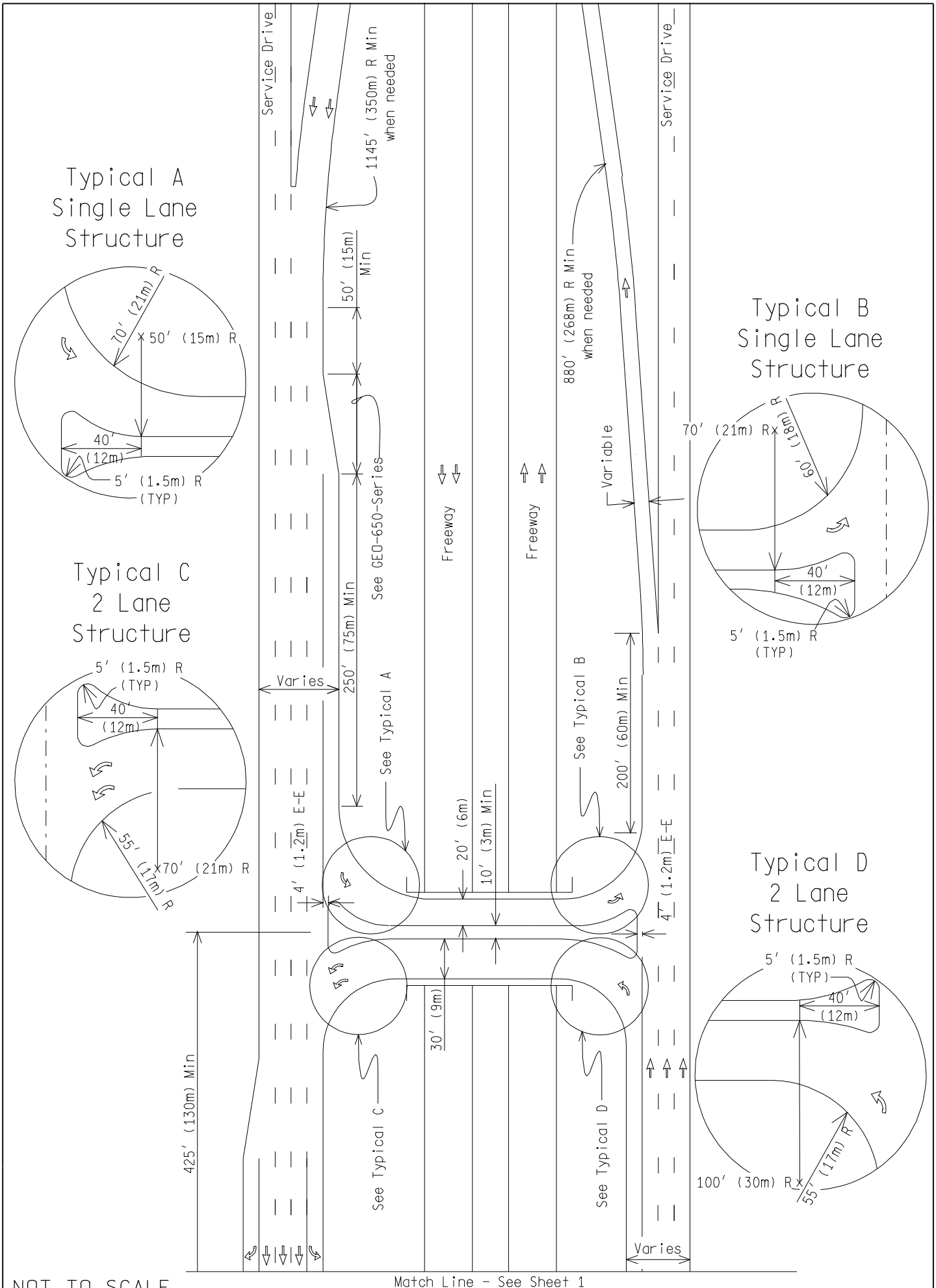
DRAWN BY: ECH
CHECKED BY: IRG/JAT
FILE:PW RD TS Geo/mdot traf GEO-400-B.dgn REV. 01/20/2010

GEOMETRIC DESIGN GUIDE FOR
URBAN DIAMOND INTERCHANGE

06/03/2010
PLAN DATE:

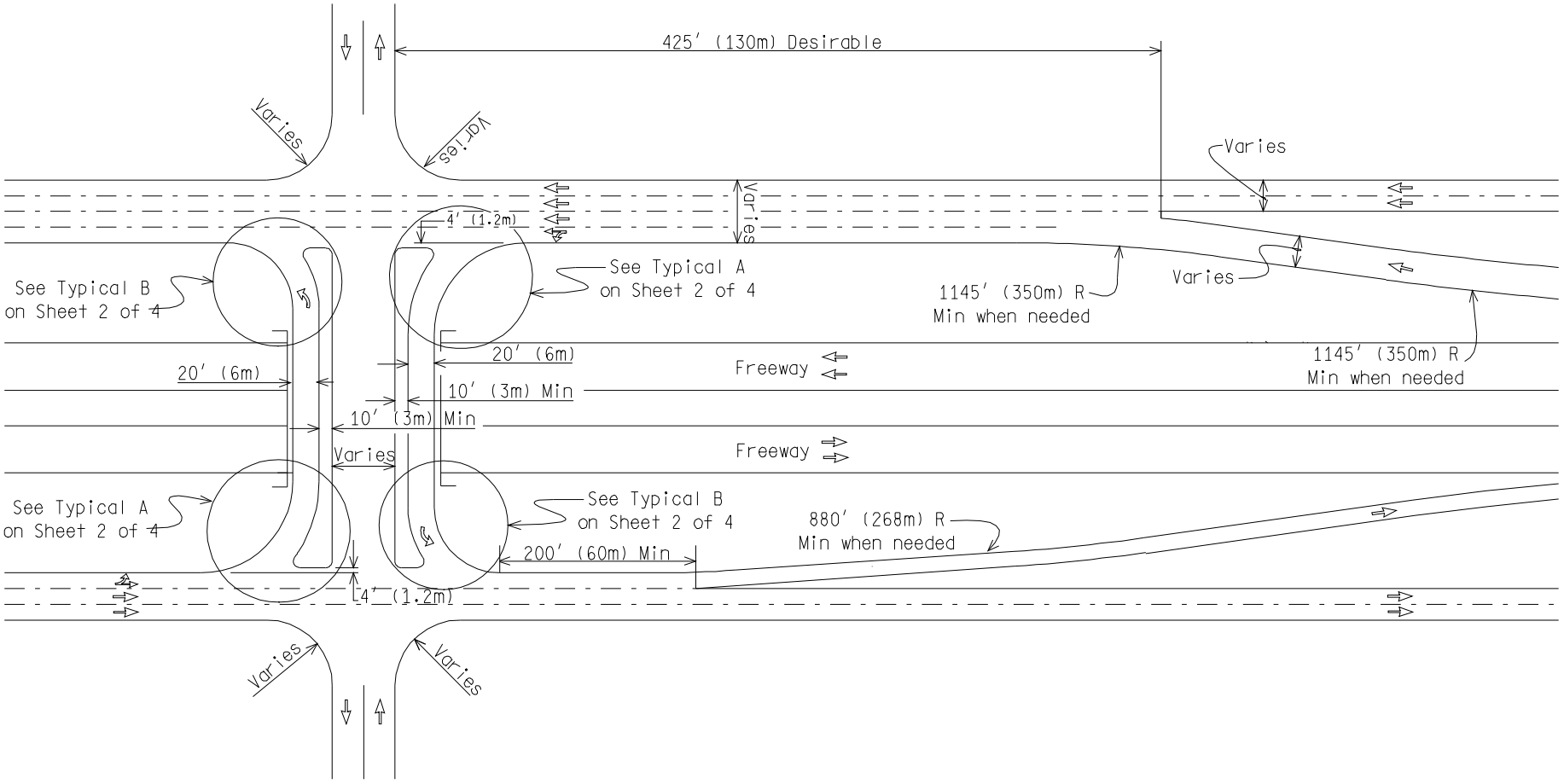
GEO-400-B

SHEET 1 OF 4


Typical A
Single Lane
Structure
70' (21m) R
50' (15m) R
40'
(12m)
5' (1.5m) R
(TYP)
Typical C
2 Lane
Structure
5' (1.5m) R
(TYP)
40'
(12m)
55' (17m) R
70' (21m) R
Service Drive
1145' (350m) R Min
when needed
50' (15m)
Min
See GEO-650-Series
250' (75m) Min
Varies
See Typical A
4' (1.2m) E-E
Freeway
Freeway
880' (268m) R Min
when needed
Variable
See Typical B
200' (60m) Min
20' (6m)
10' (3m) Min
4' (1.2m) E-E
30' (9m)
425' (130m) Min
See Typical C
See Typical D
Varies
Service Drive
Typical B
Single Lane
Structure
70' (21m) R
60' (18m) R
40'
(12m)
5' (1.5m) R
(TYP)
Typical D
2 Lane
Structure
5' (1.5m) R
(TYP)
40'
(12m)
100' (30m) R
55' (17m) R
Match Line - See Sheet 1

NOT TO SCALE

NOT TO SCALE



U-TURN FACILITY AT THE STRUCTURE

NOTES:

1. Vertical curb on ramps should be removed for a minimum distance of 200′ (60m) from the ramp nose or bifurcation and entirely removed on freeway mainlines.

2. Where curb is called for on a service drive or cross street, provide a minimum 100′ (30m) of sloped curb beyond the exit nose.

3. Refer to geometric design guide GEO-650-Series for taper lengths, intersection radii, and auxiliary lane storage length.

4. A capacity analysis should be performed at each intersection to determine the type and number of lanes needed.

5. If radii shown can not be obtained at the u-turn structure, bridge width may need to be widened.

6. Current AASHTO "A Policy on Geometric Design of Highways and Streets" and MDOT Guidelines should be used for sight distance requirements.

7. Spirals should be used on new alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series.

8. The cross slope in the gore area between the 2′ (0.6m) point and the 22′ (6.7m) point should not exceed 8%, with a 6% maximum algebraic difference in grades between the gore and the adjacent paved shoulder.

9. The design speed of the vertical alignment should meet or exceed the design speed of the horizontal alignment.

10. Each ramp should be carefully studied to provide maximum vision at its merge points. See Geometric Design Guide GEO-300-Series.

11. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Review and Congestion Analysis Unit, Division of Operations.

NOT TO SCALE

MDOT
Michigan Department of Transportation
TRAFFIC AND SAFETY

DRAWN BY: ECH
CHECKED BY: IRG/JAT
FILE:P:W:RD/T&S/Typicals/Geom D/GEO500C.dgn

BY: John C Pucell
ENGINEER OF DELIVERY

BY: P.W. Forbes
ENGINEER OF DEVELOPMENT

REV. 10/21/2008 jt

GEOMETRIC DESIGN GUIDE FOR REST AREA

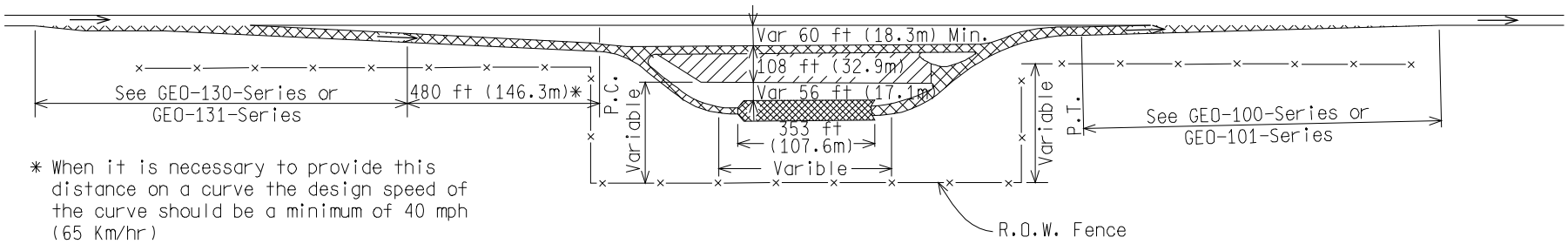
08/07/2008
PLAN DATE:

GEO-500-C

SHEET 1 OF 2

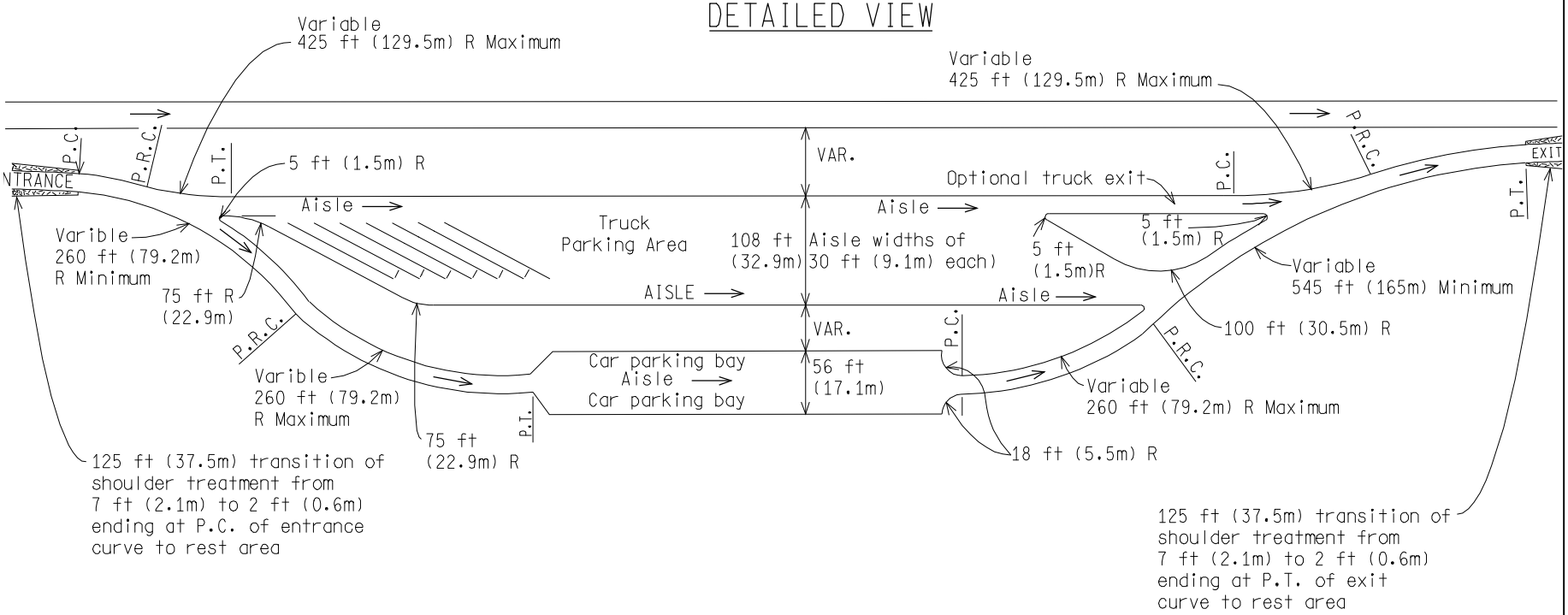
NOT TO SCALE

PLAN VIEW



* When it is necessary to provide this distance on a curve the design speed of the curve should be a minimum of 40 mph (65 Km/hr)

DETAILED VIEW



Note: For truck stall and car stall layout, see the Road Design Manual.

NOTES:

1. The designer has the flexibility to choose the taper type ramp or the parallel type ramp. However, the same type of entrance and exit ramp should be used within a rest area and corridor. Uniformity in design is needed to aid driver expectancy.

2. Entrance and exit ramps should be designed in accordance with GEO-100-Series, GEO-101-Series, GEO-130-Series and/or GEO-131-Series as appropriate.

3. Each ramp should be carefully studied to provide maximum vision at its merge points. See Geometric Design Guide GEO-300-Series.

4. Current AASHTO "A Policy on Geometric Design of Highways and Streets" and MDOT Guidelines should be used for sight distance calculations.

5. Superelevation of the curves within the rest area layout is not recommended.

6. Four foot (1.2m) shoulders are recommended. However, shoulder width should be modified to meet the current Road Standards, the current Road Design Manual, and as recommended by the Geometric Design Unit of Lansing Traffic and Safety."

7. Curb is to be used for traffic control. The type and location of curb will be shown on design plans. See the Road Design Manual and the Standard Plans for more information.

8. The orientation, size and layout of the parking areas, entrances and exits to them may be modified to fit the site conditions, capacity needs and other requirements.

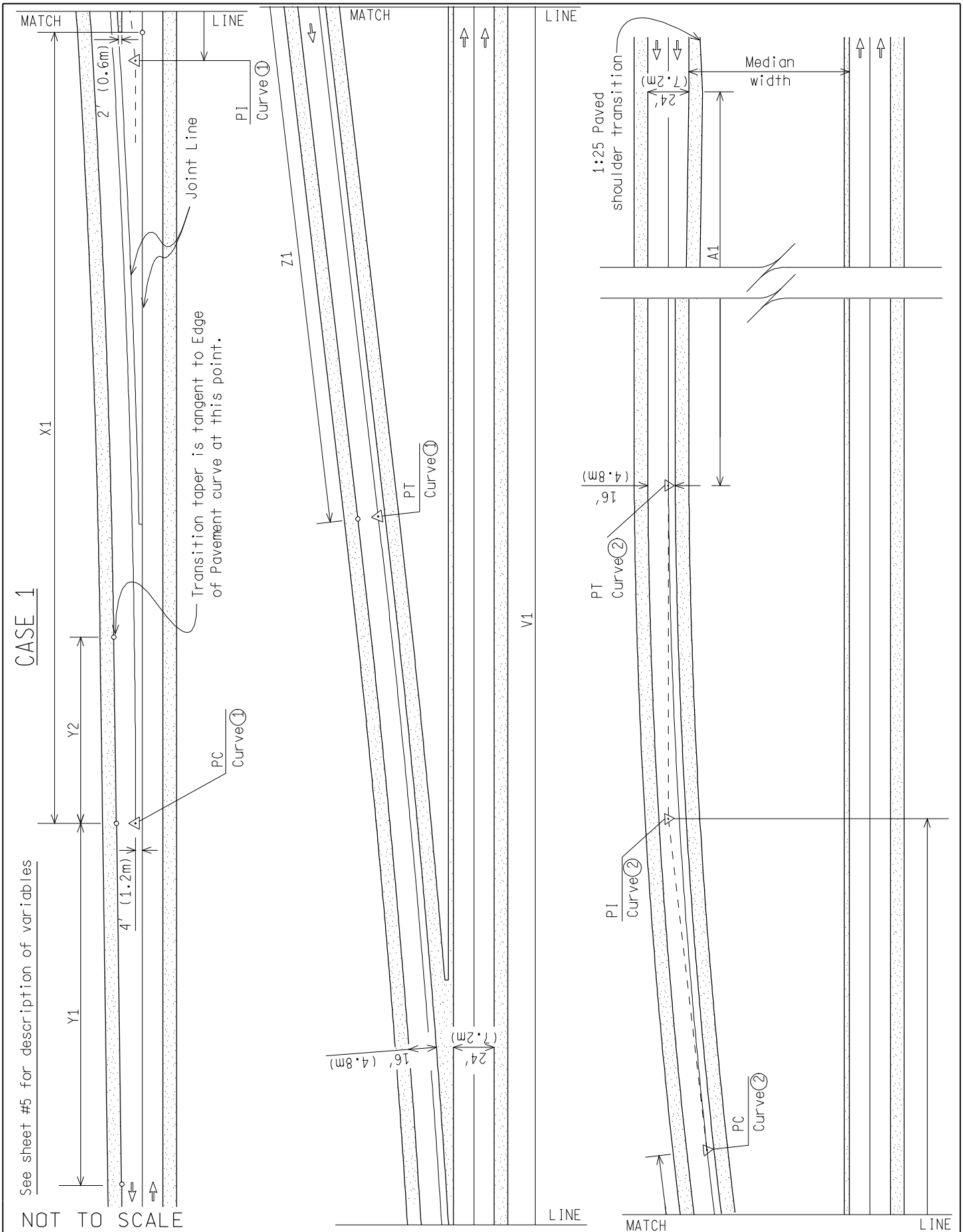
9. Pavement markings should be accordance with PAVE-956-Series and all other relevant Pavement Markings Standards and Special Details.

10. If the orientation of the rest area is different than shown, the truck parking stalls should be so situated as to keep the length of aisles to a minimum.

11. Specifically designated 12ft (3.6m) wide handicap parking stalls will be located as close as possible to walkways and entrances. See Michigan Vehicle Code and local ordinances for more information on ADA and handicap requirements.

12. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Design Unit of Lansing Traffic and Safety.

NOT TO SCALE



MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

DRAWN BY: ECH
CHECKED BY: IRG/JAT
FILE: PW RD TS Geo/mdot traf GEO-610-C.dgn

BY: John C Friend
ENGINEER OF DELIVERY

BY: Mark A Van Portfliet
ENGINEER OF DEVELOPMENT

REV. 01/20/2010

GEOMETRIC DESIGN GUIDE FOR
TWO LANE TO FOUR LANE DIVIDED TRANSITION

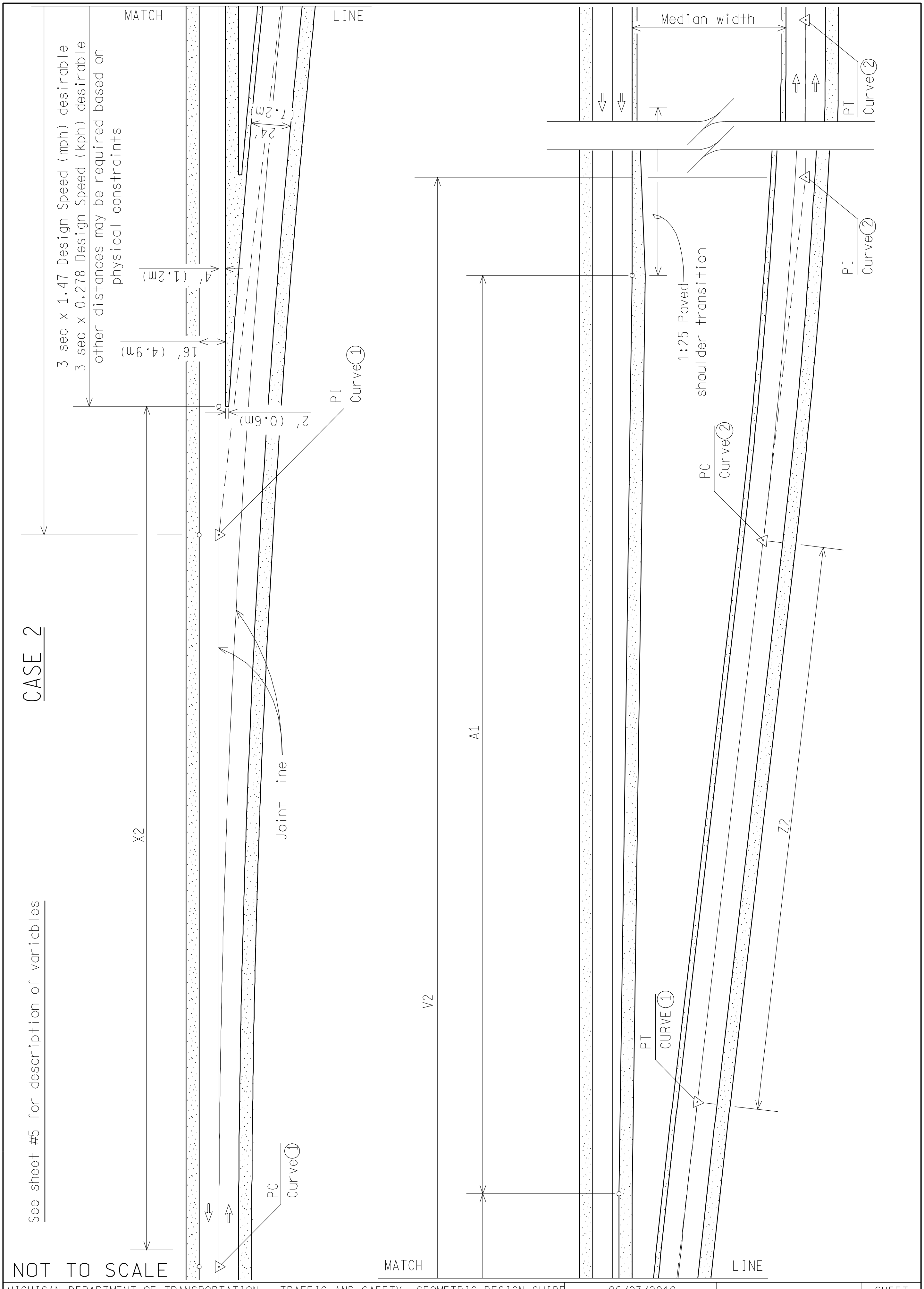
06/03/2010
PLAN DATE:

GEO-610-C

SHEET 1 OF 5

CASE 2

See sheet #5 for description of variables



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MICHIGAN DEPARTMENT OF TRANSPORTATION TRAFFIC AND SAFETY GEOMETRIC DESIGN GUIDE	06/03/2010	GEO-610-C	SHEET
FILE:PW RD TS Geo/mdot traf GEO-610-C.dgn REV. 01/20/2010	PLAN DATE:		2 OF 5

NOT TO SCALE

DESIGN SPEED	MEDIAN WIDTHS	DELTA	CURVE 1 DATA					CURVE 2 DATA					CASE 1 DATA					CASE 2 DATA			
			D1	R1	T1	L1	E1	D2	R2	T2	L2	E2	V1	Z1	X1	Y1	Y2	V2	Z2	X2	A1
70	94	6°41′	0°45′	7639.44	446.06	891.11	13.01	1°30′	3819.72	223.03	445.56	6.51	972.88	310.44	462.41	225.52	108.96	1007.01	344.81	524.53	840
	84	6°19′	0°45′	7639.44	421.54	842.22	11.62	1°30′	3819.72	210.77	421.11	5.81	939.51	312.95	462.41	225.52	108.96	975.65	349.30	524.53	840
	70	5°48′	0°45′	7639.44	387.00	773.33	9.80	1°30′	3819.72	193.50	386.67	4.90	886.03	310.10	462.41	225.52	108.96	925.41	349.68	524.53	840
	60	5°23′	0°45′	7639.44	359.15	717.78	8.44	1°30′	3819.72	179.58	358.89	4.22	848.95	313.98	462.41	225.52	108.96	891.39	356.61	524.53	840
	46	4°48′	0°45′	7639.44	320.19	640.00	6.71	1°30′	3819.72	160.09	320.00	3.35	785.97	308.46	462.41	225.52	108.96	833.61	356.26	524.53	840
	36	4°19′	0°45′	7639.44	287.91	575.56	5.42	1°30′	3819.72	143.96	287.78	2.71	741.89	312.13	462.41	225.52	108.96	794.88	365.27	524.53	840
	26	3°49′	0°45′	7639.44	254.54	508.89	4.24	1°30′	3819.72	127.27	254.44	2.12	689.53	309.25	462.41	225.52	108.96	749.49	369.35	524.75	840
60	94	7°38′	1°10′	4911.07	327.63	654.29	10.92	3°30′	1637.02	109.21	218.10	3.64	850.62	421.38	370.71	199.18	81.64	880.46	451.50	420.60	720
	84	7°11′	1°10′	4911.07	308.26	615.71	9.67	3°30′	1637.02	102.75	205.24	3.22	825.18	420.69	370.71	199.18	81.64	856.91	452.68	420.60	720
	70	6°31′	1°10′	4911.07	279.59	558.57	7.95	3°30′	1637.02	93.20	186.19	2.65	787.88	420.22	370.71	199.18	81.64	822.90	455.47	420.60	720
	60	6°00′	1°10′	4911.07	257.38	514.29	6.74	3°30′	1637.02	85.79	171.43	2.25	761.15	422.17	370.71	199.18	81.64	799.21	460.44	420.60	720
	46	5°15′	1°10′	4911.07	225.16	450.00	5.16	3°30′	1637.02	75.05	150.00	1.72	718.27	421.09	370.71	199.18	81.64	761.80	464.80	420.60	720
	36	4°40′	1°10′	4911.07	200.11	400.00	4.08	3°30′	1637.02	66.70	133.33	1.36	686.03	421.50	370.71	199.18	81.64	735.03	470.66	421.11	720
	26	4°02′	1°10′	4911.07	172.93	345.71	3.04	3°30′	1637.02	57.64	115.24	1.01	652.38	423.42	371.62	199.18	81.64	709.10	480.29	428.63	720
50	94	8°50′	1°30′	3819.72	295.03	588.89	11.38	5°30′	1041.74	80.46	160.61	3.10	733.57	366.89	326.91	161.93	76.14	759.31	392.93	370.97	600
	84	8°19′	1°30′	3819.72	277.71	554.44	10.08	5°30′	1041.74	75.74	151.21	2.75	711.45	365.56	326.91	161.93	76.14	738.81	393.21	370.97	600
	70	7°32′	1°30′	3819.72	251.47	502.22	8.27	5°30′	1041.74	68.58	136.97	2.26	680.56	366.43	326.91	161.93	76.14	710.81	396.94	370.97	600
	60	6°57′	1°30′	3819.72	231.95	463.33	7.04	5°30′	1041.74	63.26	126.36	1.92	656.28	365.93	326.91	161.93	76.14	689.10	398.99	370.97	600
	46	6°04′	1°30′	3819.72	202.41	404.44	5.36	5°30′	1041.74	55.20	110.30	1.46	621.00	366.88	326.91	161.93	76.14	658.63	404.73	370.97	600
	36	5°24′	1°30′	3819.72	180.13	360.00	4.25	5°30′	1041.74	49.13	98.18	1.16	592.42	365.80	326.91	161.93	76.14	634.73	408.30	371.12	600
	26	4°40′	1°30′	3819.72	155.64	311.11	3.17	5°30′	1041.74	42.45	84.85	0.86	563.52	367.31	327.31	161.93	76.14	612.53	416.47	376.64	600
40	94	10°21′	2°00′	2864.79	259.46	517.50	11.73	7°30′	763.94	69.19	138.00	3.13	624.20	305.88	283.07	124.35	71.30	646.11	328.15	321.31	320
	84	9°44′	2°00′	2864.79	243.92	486.67	10.37	7°30′	763.94	65.05	129.78	2.76	606.30	306.19	283.07	124.35	71.30	629.62	329.85	321.31	320
	70	8°50′	2°00′	2864.79	221.47	441.67	8.53	7°30′	763.94	59.01	117.78	2.28	579.14	305.81	283.07	124.35	71.30	604.88	331.86	321.31	320
	60	8°09′	2°00′	2864.79	204.09	407.50	7.26	7°30′	763.94	54.43	108.67	1.94	558.61	305.79	283.07	124.35	71.30	586.54	334.01	321.31	320
	46	7°08′	2°00′	2864.79	178.56	356.67	5.56	7°30′	763.94	47.62	95.11	1.48	527.38	305.31	283.07	124.35	71.30	559.34	337.52	321.31	320
	36	6°21′	2°00′	2864.79	158.91	317.50	4.40	7°30′	763.94	42.38	84.67	1.17	503.22	305.03	283.07	124.35	71.30	539.16	341.20	321.33	320
	26	5°30′	2°00′	2864.79	137.61	275.00	3.30	7°30′	763.94	36.69	73.33	0.88	477.73	305.64	283.19	124.35	71.30	519.27	347.37	325.12	320

*Note all distances are in feet and speeds in mph. Values are based on a 12′ lane width.

NOT TO SCALE

DESIGN SPEED	MEDIAN WIDTHS	DELTA	CURVE 1 DATA				CURVE 2 DATA				CASE 1 DATA					CASE 2 DATA			
			R1	T1	L1	E1	R2	T2	L2	E2	V1	Z1	X1	Y1	Y2	V2	Z2	X2	A1
120	29	6°33′	2400	137.33	274.37	3.93	1200	68.67	137.18	1.96	304.83	100.83	141.96	73.41	32.14	315.28	111.35	161.03	270
	26	6°13′	2400	130.33	260.40	3.54	1200	65.16	130.20	1.77	293.77	100.01	141.96	73.41	32.14	304.79	111.09	161.03	270
	21	5°36′	2400	117.38	234.57	2.87	1200	58.69	117.29	1.43	275.37	100.62	141.96	73.41	32.14	287.61	112.92	161.03	270
	18	5°12′	2400	108.98	217.82	2.47	1200	54.49	108.91	1.24	263.72	101.33	141.96	73.41	32.14	276.90	114.57	161.03	270
	14	4°39′	2400	97.44	194.78	1.98	1200	48.72	97.39	0.99	245.89	100.54	141.96	73.41	32.14	260.65	115.34	161.03	270
	11	4°12′	2400	88.00	175.93	1.61	1200	44.00	87.96	0.81	231.50	100.11	141.96	73.41	32.14	247.84	116.50	161.03	270
	8	3°42′	2400	77.52	154.99	1.25	1200	38.76	77.49	0.63	216.49	100.67	141.96	73.41	32.14	235.05	119.26	161.14	270
100	29	7°32′	1500	98.75	197.22	3.25	500	32.92	65.74	1.08	264.66	135.29	112.22	62.52	24.08	273.74	144.45	127.32	225
	26	7°05′	1500	92.84	185.44	2.87	500	30.95	61.81	0.96	257.52	135.72	112.22	62.52	24.08	267.18	145.45	127.32	225
	21	6°19′	1500	82.77	165.37	2.28	500	27.59	55.12	0.76	243.91	135.04	112.22	62.52	24.08	254.75	145.95	127.32	225
	18	5°49′	1500	76.21	152.28	1.93	500	25.40	50.76	0.64	235.59	135.21	112.22	62.52	24.08	247.37	147.05	127.32	225
	14	5°06′	1500	66.80	133.52	1.49	500	22.27	44.51	0.50	224.10	135.92	112.22	62.52	24.08	237.54	149.41	127.32	225
	11	4°32′	1500	59.37	118.68	1.17	500	19.79	39.56	0.39	214.41	135.92	112.22	62.52	24.08	229.55	151.10	127.62	225
	8	3°56′	1500	51.51	102.97	0.88	500	17.17	34.32	0.29	203.61	135.42	112.22	62.52	24.08	221.07	152.91	130.17	225
80	29	8°51′	1200	92.86	185.35	3.59	350	27.08	54.06	1.05	224.79	107.55	100.36	47.62	24.06	232.50	115.35	113.88	180
	26	8°21′	1200	87.60	174.88	3.19	350	25.55	51.01	0.93	218.02	107.21	100.36	47.62	24.06	226.20	115.47	113.88	180
	21	7°27′	1200	78.13	156.03	2.54	350	22.79	45.51	0.74	206.48	107.32	100.36	47.62	24.06	215.65	116.58	113.88	180
	18	6°53′	1200	72.17	144.16	2.17	350	21.05	42.05	0.63	198.81	107.04	100.36	47.62	24.06	208.75	117.05	113.88	180
	14	6°04′	1200	63.59	127.06	1.68	350	18.55	37.06	0.49	188.18	107.10	100.36	47.62	24.06	199.47	118.46	113.88	180
	11	5°24′	1200	56.59	113.10	1.33	350	16.51	32.99	0.39	179.84	107.55	100.36	47.62	24.06	192.54	120.30	113.89	180
	8	4°42′	1200	49.25	98.44	1.01	350	14.36	28.71	0.29	170.29	107.25	100.36	47.62	24.06	184.88	121.90	115.08	180
60	29	10°43′	900	84.41	168.34	3.95	250	23.45	46.76	1.10	184.94	80.36	86.90	32.72	24.04	191.28	86.81	98.64	85
	26	10°07′	900	79.66	158.91	3.52	250	22.13	44.14	0.98	179.34	80.39	86.90	32.72	24.04	186.07	87.22	98.64	85
	21	9°04′	900	71.36	142.42	2.82	250	19.82	39.56	0.78	169.20	80.16	86.90	32.72	24.04	176.72	87.77	98.64	85
	18	8°23′	900	65.96	131.69	2.41	250	18.32	36.58	0.67	162.86	80.33	86.90	32.72	24.04	171.00	88.56	98.64	85
	14	7°25′	900	58.33	116.50	1.89	250	16.20	32.36	0.52	153.64	80.40	86.90	32.72	24.04	162.86	89.70	98.64	85
	11	6°38′	900	52.16	104.20	1.51	250	14.49	28.94	0.42	146.18	80.52	86.90	32.72	24.04	156.50	90.91	98.64	85
	8	5°48′	900	45.59	91.11	1.15	250	12.66	25.31	0.32	137.83	80.28	86.90	32.72	24.04	149.64	92.15	98.94	85

*Note all distances are in meters and speeds in kph. Values are based on a 3.6m lane width.

DESCRIPTION OF VARIABLES

A1 = length of 2 to 1 transition
V1 = distance from PI of curve 1 to PI of curve 2 (case 1)
V2 = distance from PI of curve 1 to PI of curve 2 (case 2)
X1 = tangent distance along the curve to the 2′ (0.6m) point (case 1)
X2 = tangent distance along the curve to the 2′ (0.6m) point (case 2)
Y1 = distance from transitioning pavement widths
Y2 = distance into curve 1 from PC that is required such that transition taper is tangent to the curve
Z1 = distance between curve 1 and curve 2 (case 1)
Z2 = distance between curve 1 and curve 2 (case 2)

NOTES:

1. Provide the driver with sight distance along the full length of the 2 to 4 lane transition.

2. Full paved shoulders should be used along lane drop tapers. Use a 1:25 taper transition where it joins the normal median shoulder width.

3. The data provided in the tables are examples of typical situations. For combinations of design speeds, lane widths, median widths, and curve data not given in the table, the designer should interpolate a delta value (Δ) using median widths and calculate the remaining values.

4. If the lane drop is on a curve, plot offsets for taper and connect with appropriate curve. Design lane drops on tangent alignment if possible.

5. Spirals should be used on new alignments based on the design speed of the curve and the radius as shown in the table of the Road Standard Plan R-107-Series.

6. The cross slope in the gore area between the 2′ (0.6m) point and the 22′ (6.6m) point should not exceed 8%, with a 6% maximum algebraic difference in grades between the gore and the adjacent paved shoulder.

7. The design speed of the vertical alignment should meet or exceed the design speed of the horizontal alignment.

8. Each transition should be designed to provide decision sight distance at its merge points. See Geometric Design Guide GEO-300-Series.

9. Current AASHTO "A Policy on Geometric Design of Highways and Streets" and MDOT Guidelines should be used for sight distance requirements.

10. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Review and Congestion Analysis Unit of the Division of Operations.

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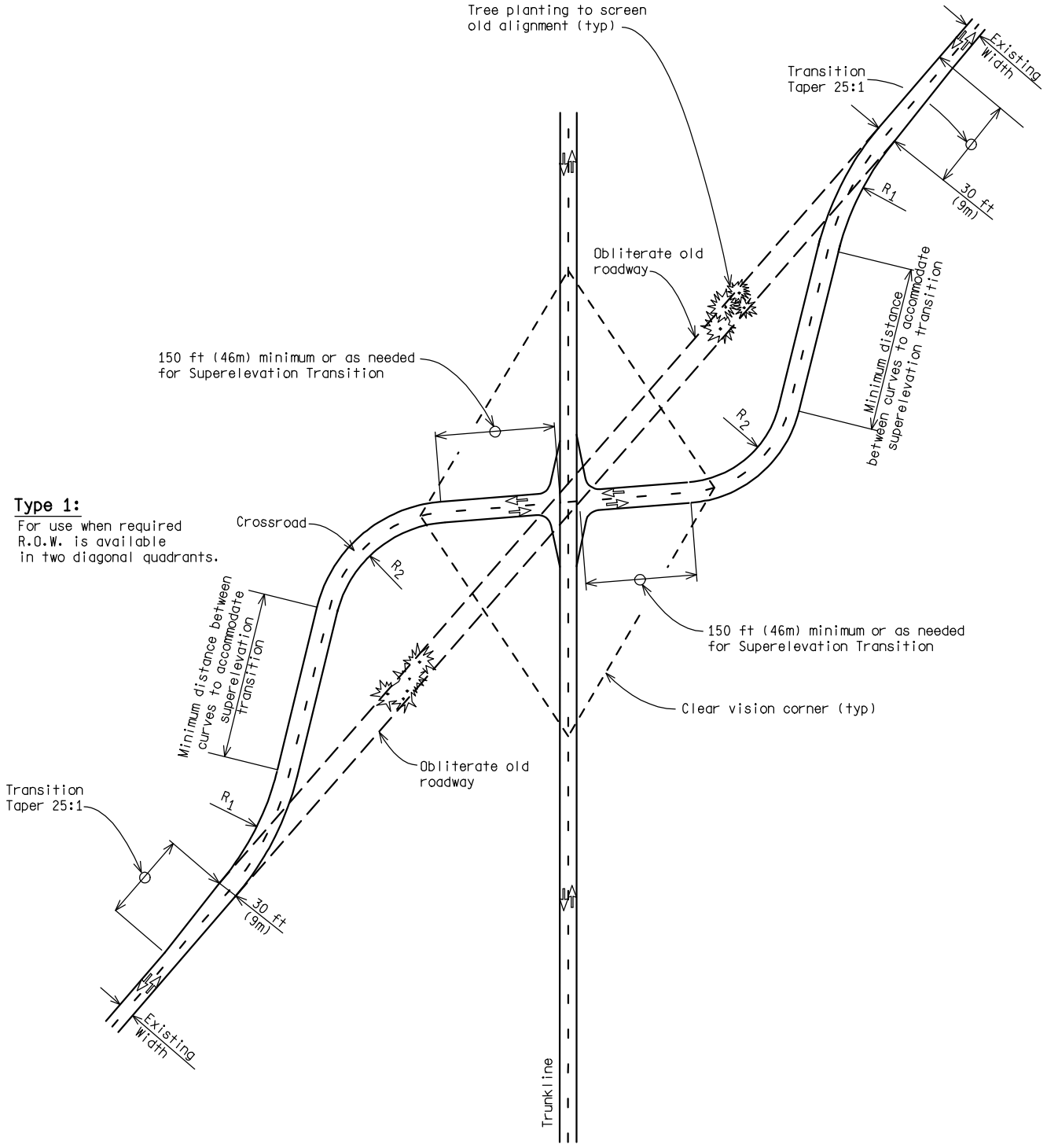

Note: See Radii and Tangent Table on sheet 5.

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MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

BY: John C. Friend
ENGINEER OF DELIVERY

BY: [signature]
ENGINEER OF DEVELOPMENT

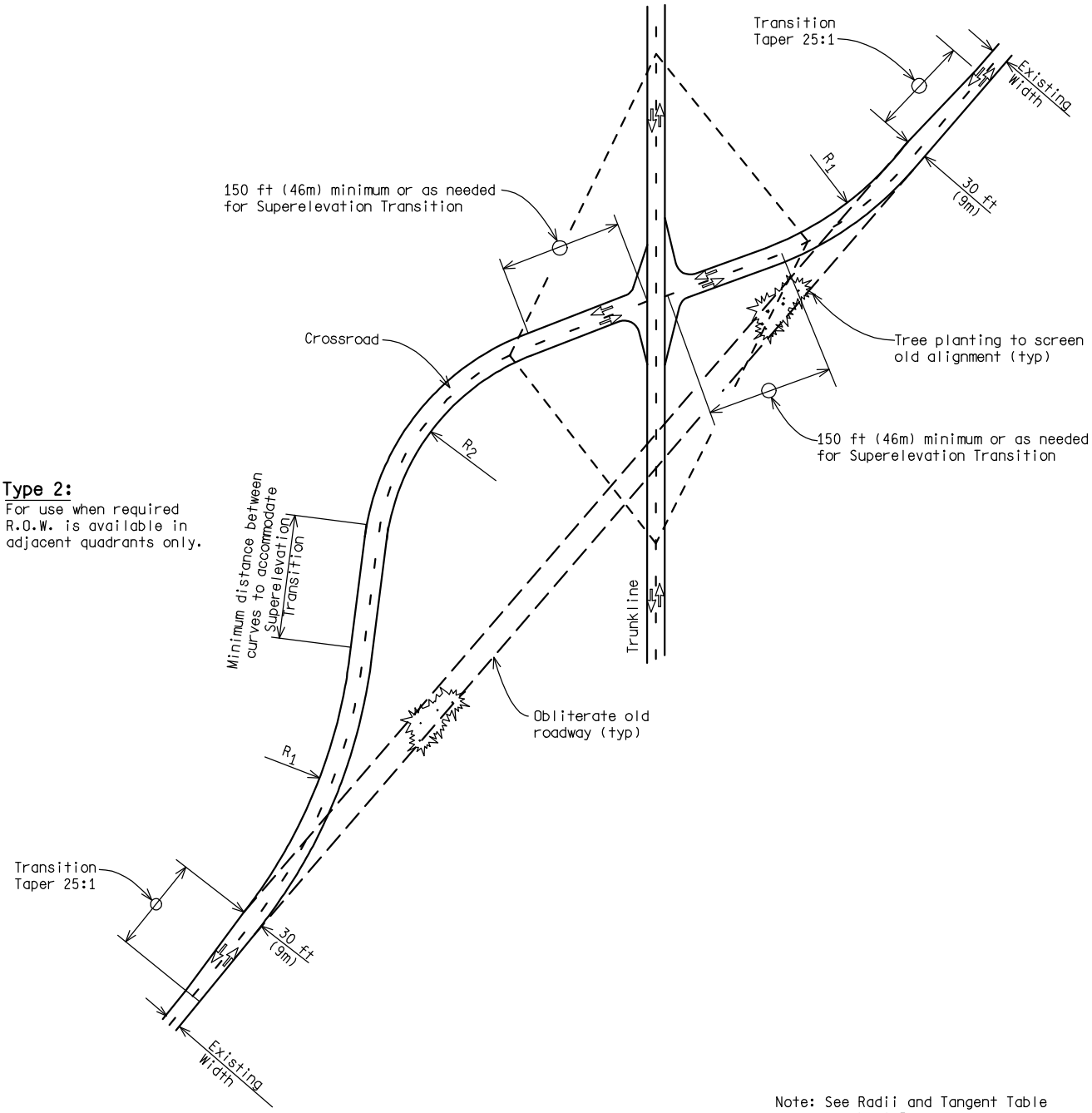
DRAWN BY: DJF
CHECKED BY: JRG/JAT
FILE: PW/RD/TS/Geom D/mdot GEO640B EOC.dgn REV. 9/19/2006

GEOMETRIC DESIGN GUIDE FOR TURNED-IN ROADWAYS

9/19/2006 PLAN DATE:

GEO-640-B

SHEET 1 OF 5



Type 2:
For use when required R.O.W. is available in adjacent quadrants only.

Note: See Radii and Tangent Table on sheet 5.

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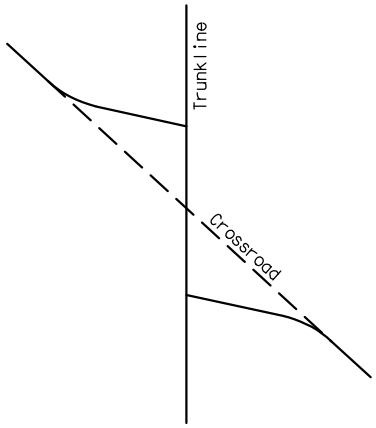
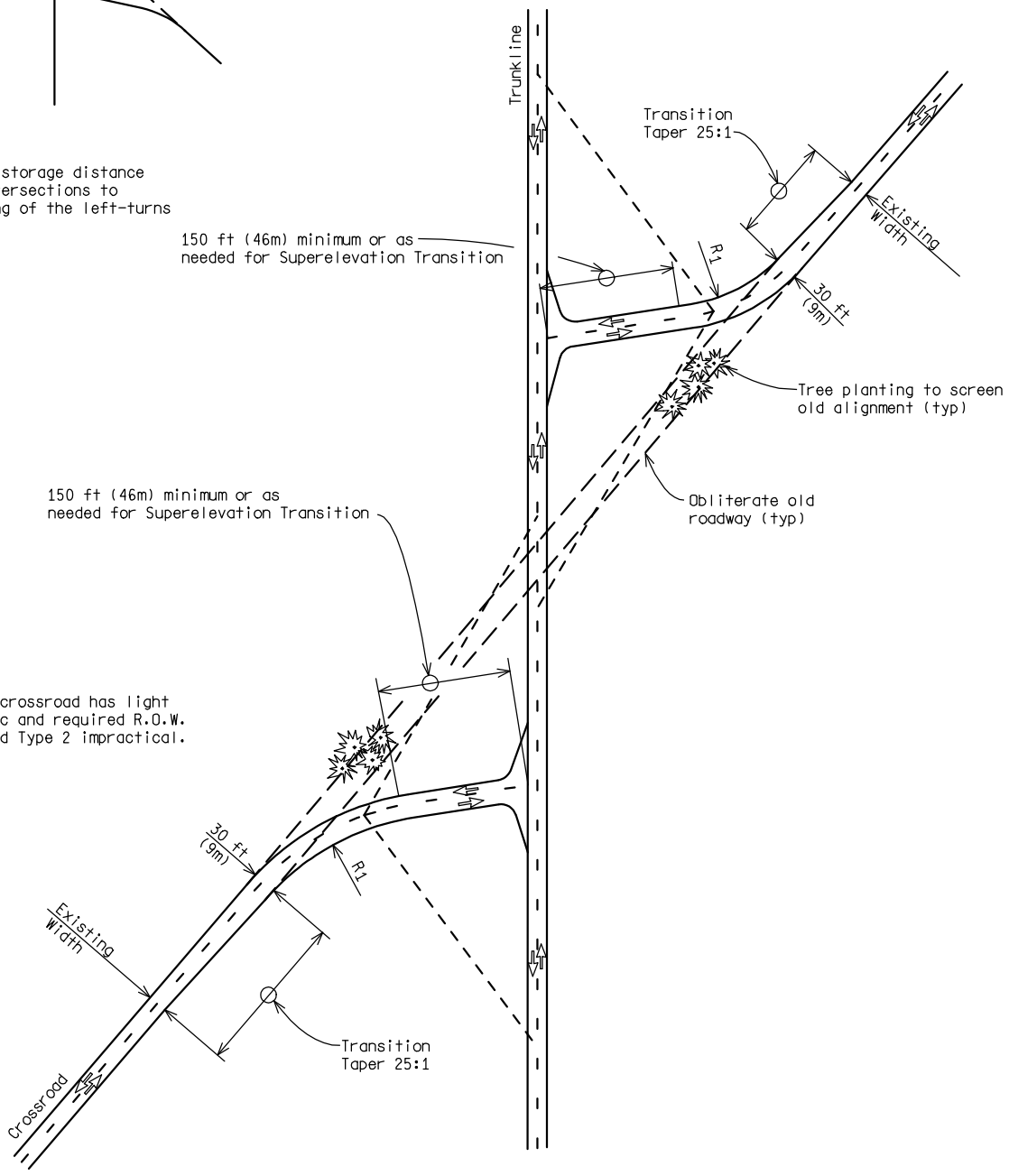


Type 3a:
Provide sufficient storage distance between the two intersections to prevent interlocking of the left-turns on the trunkline.



Type 3:
For use where crossroad has light through traffic and required R.O.W. make Type 1 and Type 2 impractical.

Note: Type 3a should be used only when Type 3 is not possible.
See Radii and Tangent Table on sheet 5.

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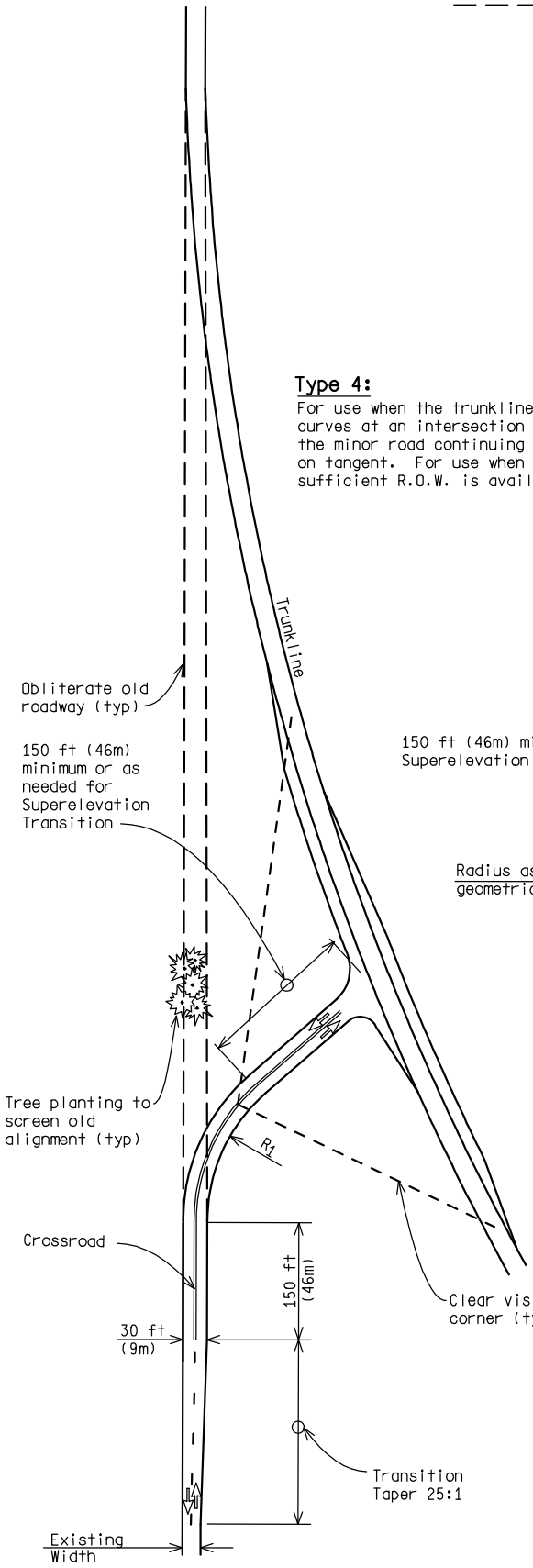
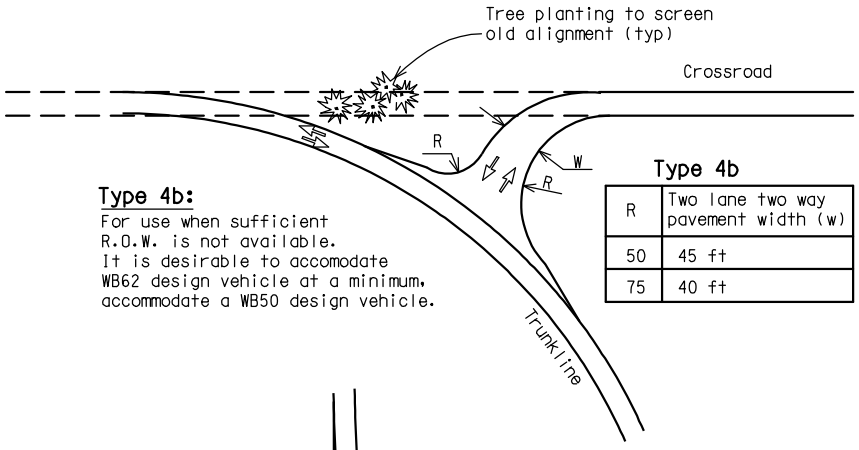
Type 4:
For use when the crossroad intersects a curving trunkline.



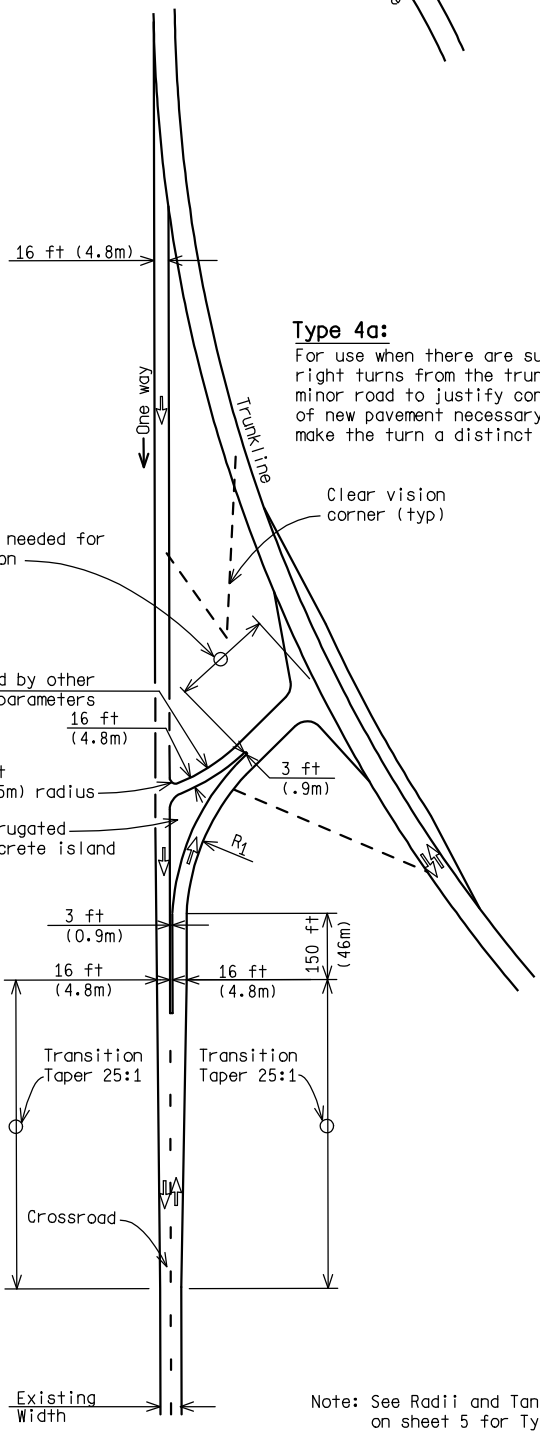


Type 4b:
For use when sufficient R.O.W. is not available. It is desirable to accomodate WB62 design vehicle at a minimum, accommodate a WB50 design vehicle.

Type 4b

R	Two lane two way pavement width (w)
50	45 ft
75	40 ft

Type 4:
For use when the trunkline curves at an intersection with the minor road continuing on tangent. For use when sufficient R.O.W. is available.



Type 4a:
For use when there are sufficient right turns from the trunkline to the minor road to justify construction of new pavement necessary to make the turn a distinct move.

Note: See Radii and Tangent Table on sheet 5 for Types 4 and 4a.

NOT TO SCALE

Radii and Tangent Table

Approach Speed R_1	R_1	Tangent Between Curves	Approach Speed R_2	R_2
20 mph 30 km/h	90 ft 27m	90 ft 27m	20 mph 30 km/h	90 ft 27m
30 mph 50 km/h	230 ft 70m	130 ft 40m	30 mph 50 km/h	230 ft 70m
40 mph 60 km/h	460 ft 140m	175 ft 53m	30 mph 50 km/h	230 ft 70m
50 mph 80 km/h	620 ft 189m	220 ft 67m	30 mph 50 km/h	230 ft 70m

NOTES:

1. Trees should not be planted within Clear Vision areas and Clear Zones.
2. An angle of intersection between the mainline and crossroad should be 90° However an angle of intersection between 75° and 105° is acceptable.
3. Tree planting of coniferous trees should be made in accordance with the tree planting guide to screen the old pavement alignment.
4. Clear vision areas as per Geometric Design Guide GEO-300-Series, should be provided at all intersections.
5. Approaching grades at the intersecting roadways should be as flat as practical, especially on the sections that are used for storage space. Grades between 2 and 3 percent are desirable. See Geometric Design Guide GEO-650-Series for further guidance.
6. Adequate intersection sight distance should be provided along both roadways.
7. Consult the Geometric Design Unit of Lansing Traffic and Safety where modifications are needed.
8. Intersection approach grades should be studied to provide adequate landing areas for adequate sight distance.

NOT TO SCALE

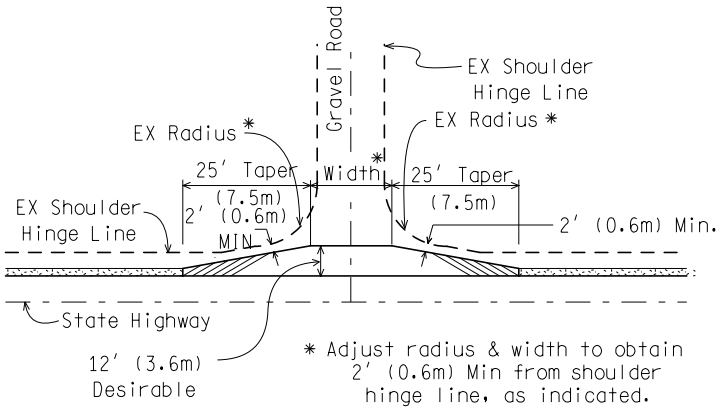
UNCURBED INTERSECTIONS

MINIMUM PAVED APRON

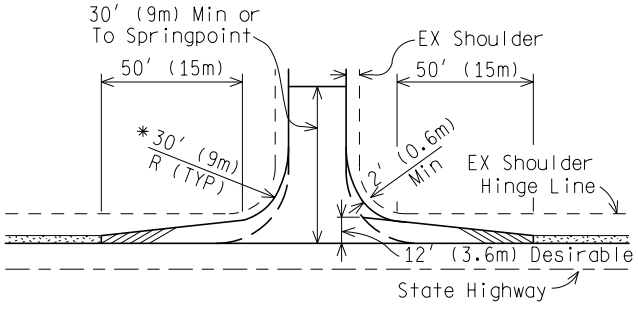
Paved shoulder

Paved as per plans

APPROACH TREATMENT DETAIL I



APPROACH TREATMENT DETAIL II



NOT TO SCALE

MDOT Michigan Department of Transportation TRAFFIC AND SAFETY	BY: John C Friend ENGINEER OF DELIVERY	GEOMETRIC DESIGN GUIDE FOR FLARES AND INTERSECTION DETAILS	
DRAWN BY: ECH CHECKED BY: IRG/JAT	BY: Paul A VanPatten ENGINEER OF DEVELOPMENT	06/03/2010 PLAN DATE:	GEO-650-D
FILE: PW RD TS Geo/mdot traf GEO-650-D.dgn	REV. 05/03/2017		SHEET 1 OF 7

CURBED INTERSECTIONS

APPROACH TREATMENT DETAIL III

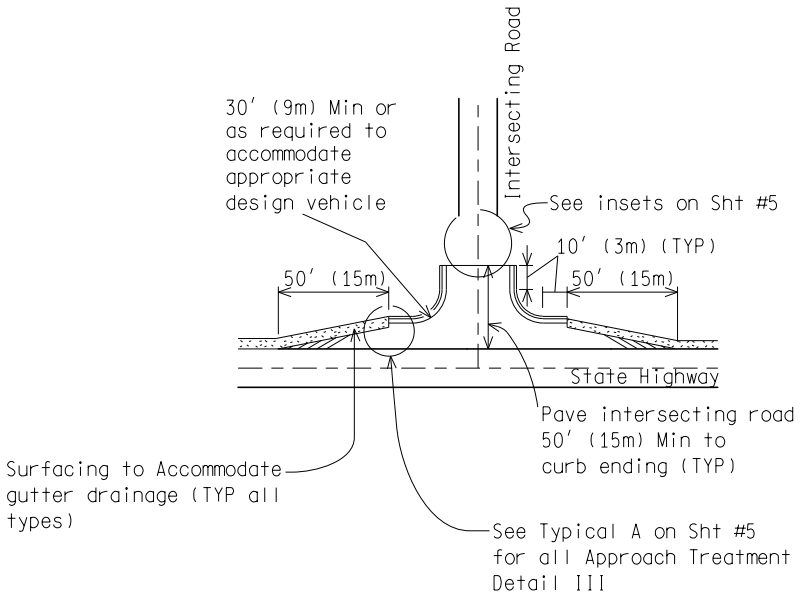
MINIMUM PAVED APRON

Paved shoulder

Paved as per plans

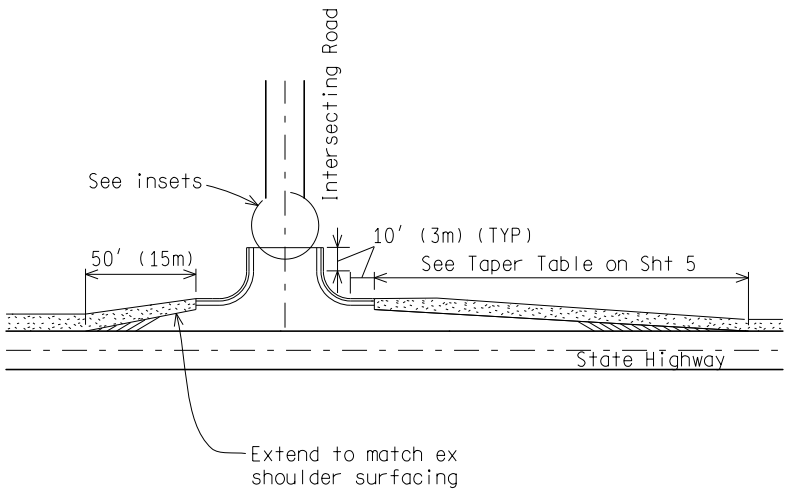
TYPE 1: MINIMUM CURBED CONNECTION

Curbed radii should be used on major collector roads, when gravel accumulation and/or vehicle encroachment is a problem, or when roadside control is desirable.



TYPE 2: RIGHT TURN TAPER

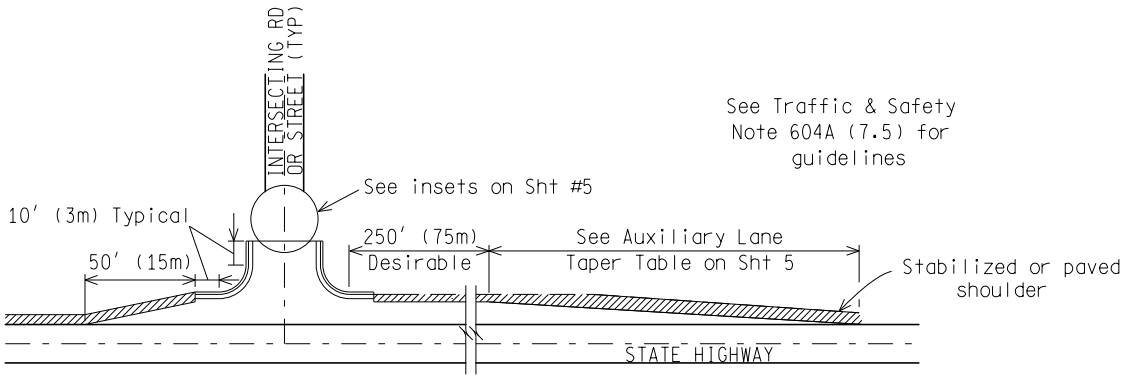
See Traffic & Safety Note 604A (7.5) for Guidelines



NOT TO SCALE

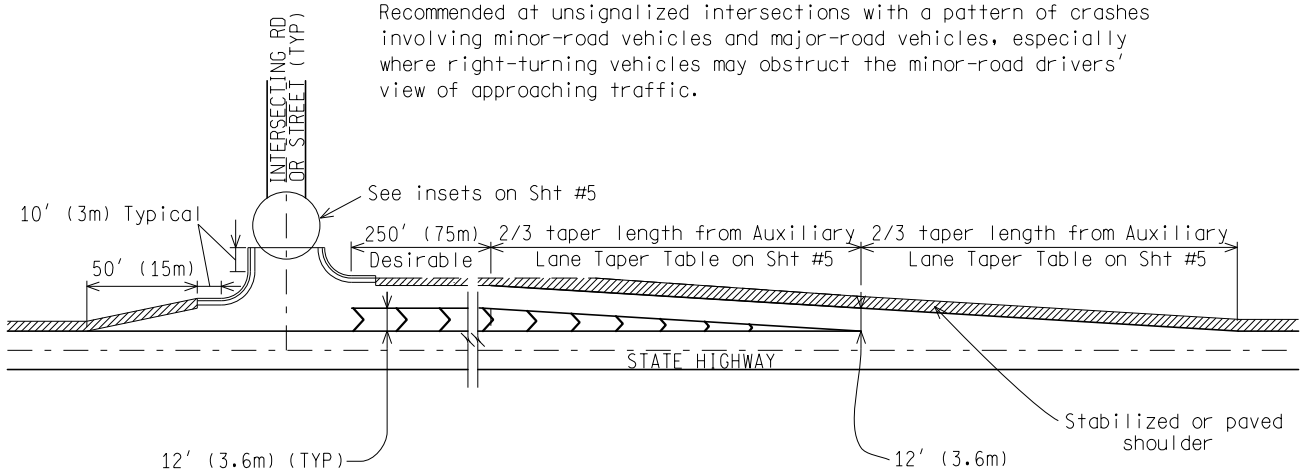
CURBED INTERSECTIONS
APPROACH TREATMENT DETAIL III

TYPE 3: RIGHT TURN LANE

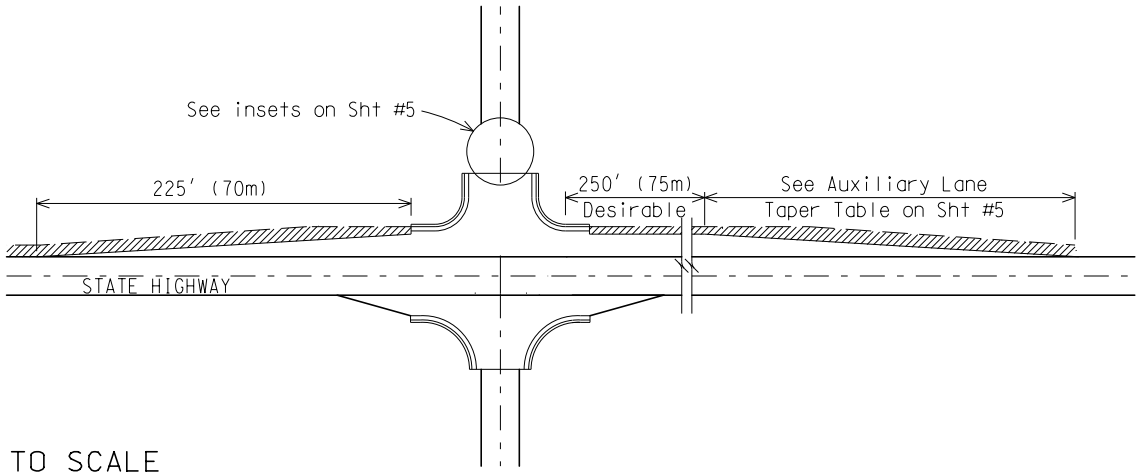


TYPE 3 MODIFIED: OFFSET RIGHT TURN LANE

Recommended at unsignalized intersections with a pattern of crashes involving minor-road vehicles and major-road vehicles, especially where right-turning vehicles may obstruct the minor-road drivers' view of approaching traffic.

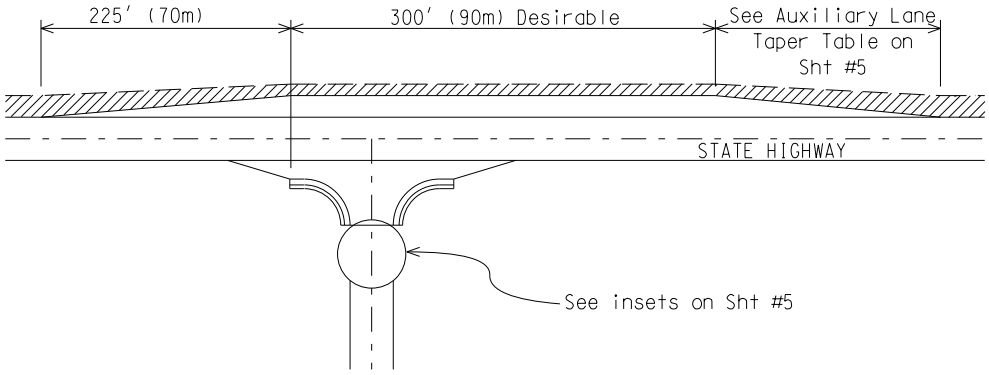


TYPE 4: DIRECTIONAL PASSING FLARE
(2 LANE HIGHWAYS)



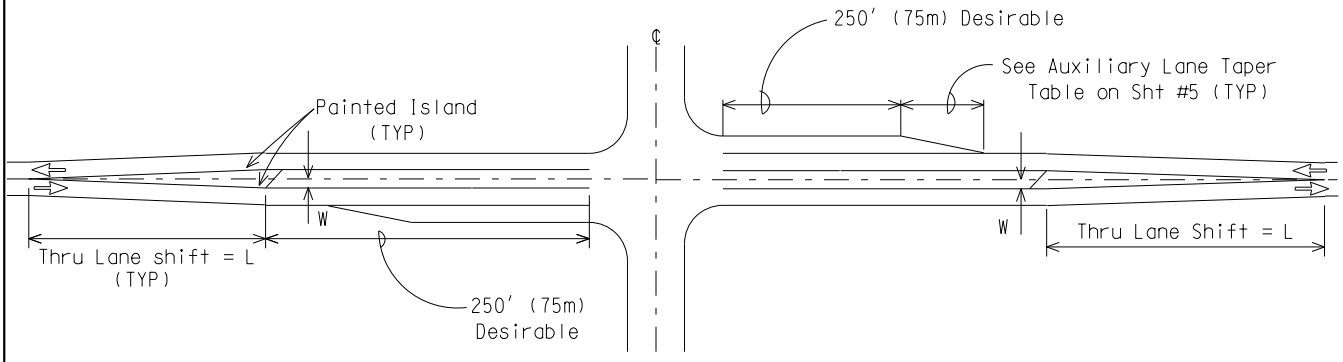
NOT TO SCALE

TYPE 4 MODIFIED: PASSING FLARE, FOR T-INTERSECTIONS



TYPE 5: TWO TO THREE LANE TRANSITION FOR CENTER LANE FOR LEFT TURNS

(RIGHT TURN LANE OPTIONAL)



THRU LANE SHIFT L (TYP)

For Posted Speeds 45 mph (70 kph) or more:

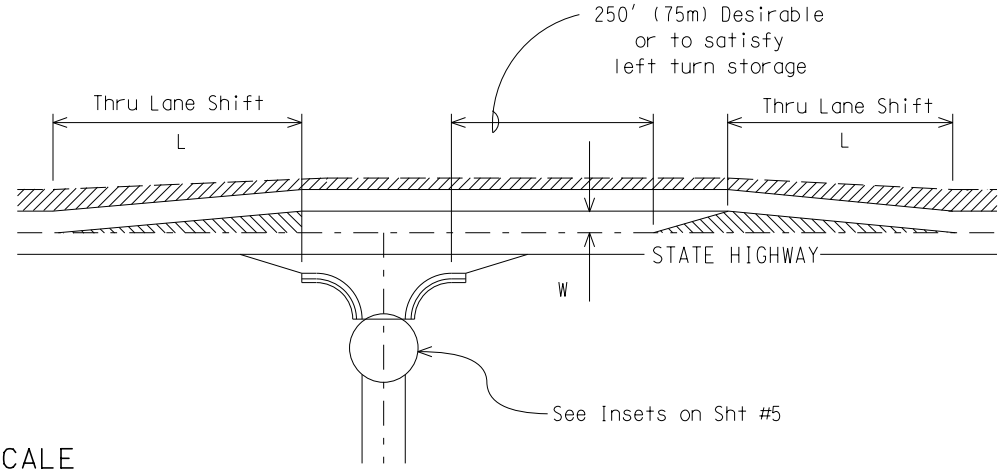
$L = WS$ ($L = 0.62WS$)

For Posted Speeds less than 45 mph (70 kph):

$L = \frac{WS^2}{60}$ ($L = \frac{WS^2}{155}$)

L= length in feet (meters)
S= posted speed in mph (kph)
W= offset in feet (meters)

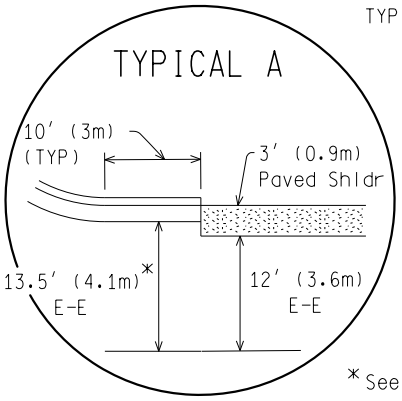
TYPE 5: MODIFIED (LEFT TURN LANE), FOR T-INTERSECTIONS

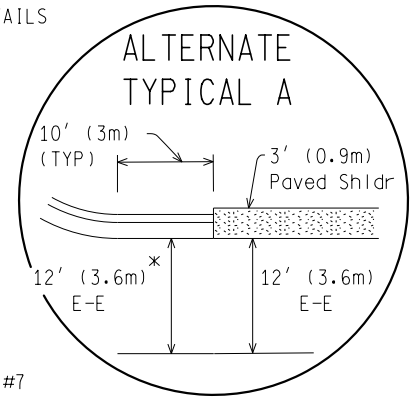


NOT TO SCALE

CURB RETURN OFFSET DETAILS

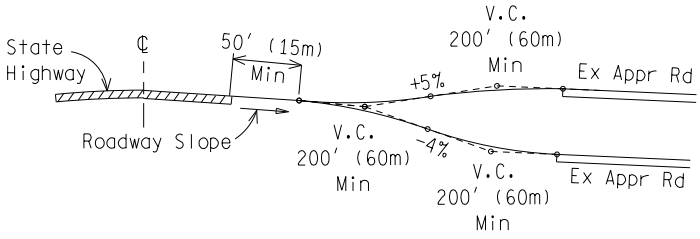
TYPICAL FOR ALL DETAILS





*See Note #6 on Sht #7

ALLOWABLE APPROACH ROAD GRADES



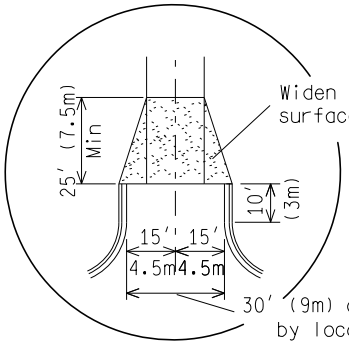
AUXILIARY LANE TAPER TABLE

Not to be used for transitioning through traffic. The taper rate is the same for both curbed and uncurbed roadways.

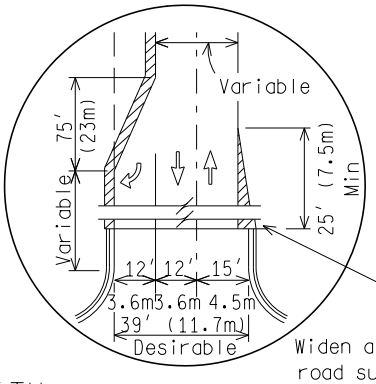
Posted Speed MPH (kph)	Taper Ft (m)
≤ 35 (≤ 60)	75 (23)
40 (60)	100 (30)
45 (70)	130 (40)
50 (80)	180 (55)
55 (90)	225 (70)

INSETS

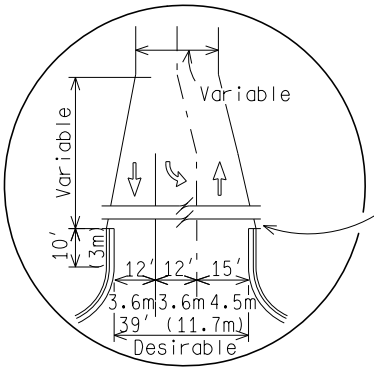
INTERSECTING ROAD WITH OR WITHOUT SHOULDERS



INTERSECTING ROAD WITH ADDED RIGHT TURN LANE



INTERSECTING ROAD WITH ADDED LEFT TURN LANE



NOT TO SCALE

TABLE OF RADII FOR DESIGN VEHICLES

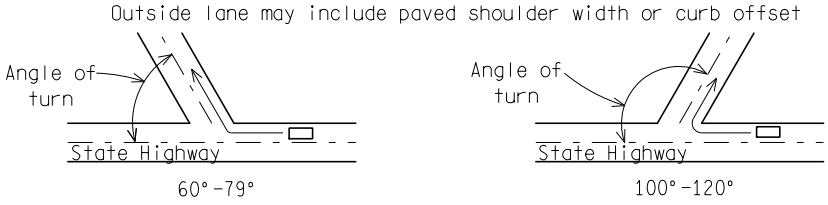
SEE NOTE 4

TABLE 1 (R*)

TURN FROM 12′ (3.6m) OUTSIDE LANE TO 12′ (3.6m) OUTSIDE LANE			
DESIGN VEHICLES	ANGLES OF TURN		
	60°-79°	80°-99°	100°-120°
P	30′ (9m)R	30′ (9m)R	30′ (9m)R
SU	50′ (15m)R	50′ (15m)R	40′ (12m)R
WB-50	90′ (27m)R	80′ (24m)R	60′ (18m)R
WB-65	170′ (51m)R	110′ (33m)R	80′ (24m)R

TABLE 2 (R**)

TURN FROM 12′ (3.6m) OUTSIDE LANE TO 20′ (6m) OUTSIDE LANE			
DESIGN VEHICLES	ANGLES OF TURN		
	60°-79°	80°-99°	100°-120°
P	30′ (9m)R	30′ (9m)R	30′ (9m)R
SU	30′ (9m)R	30′ (9m)R	30′ (9m)R
WB-50	50′ (15m)R	50′ (15m)R	40′ (12m)R
WB-65	70′ (21m)R	60′ (18m)R	50′ (15m)R



1. Design vehicles; P=Passenger Car, SU=Single Unit Truck (30′ (9m) overall), WB-50=Tractor-Trailer Combination (50′ (15m) wheelbase), WB-65=Interstate Semi-Trailer (65′ (19.8m) wheelbase).

2. The angle of intersection between the approach road and the trunkline should not be less than 60° or more than 120°, with desirable values between 75° and 105°.

3. The above tables are to be used as a guide, turning vehicle templates or AutoTurn should be used for verification.

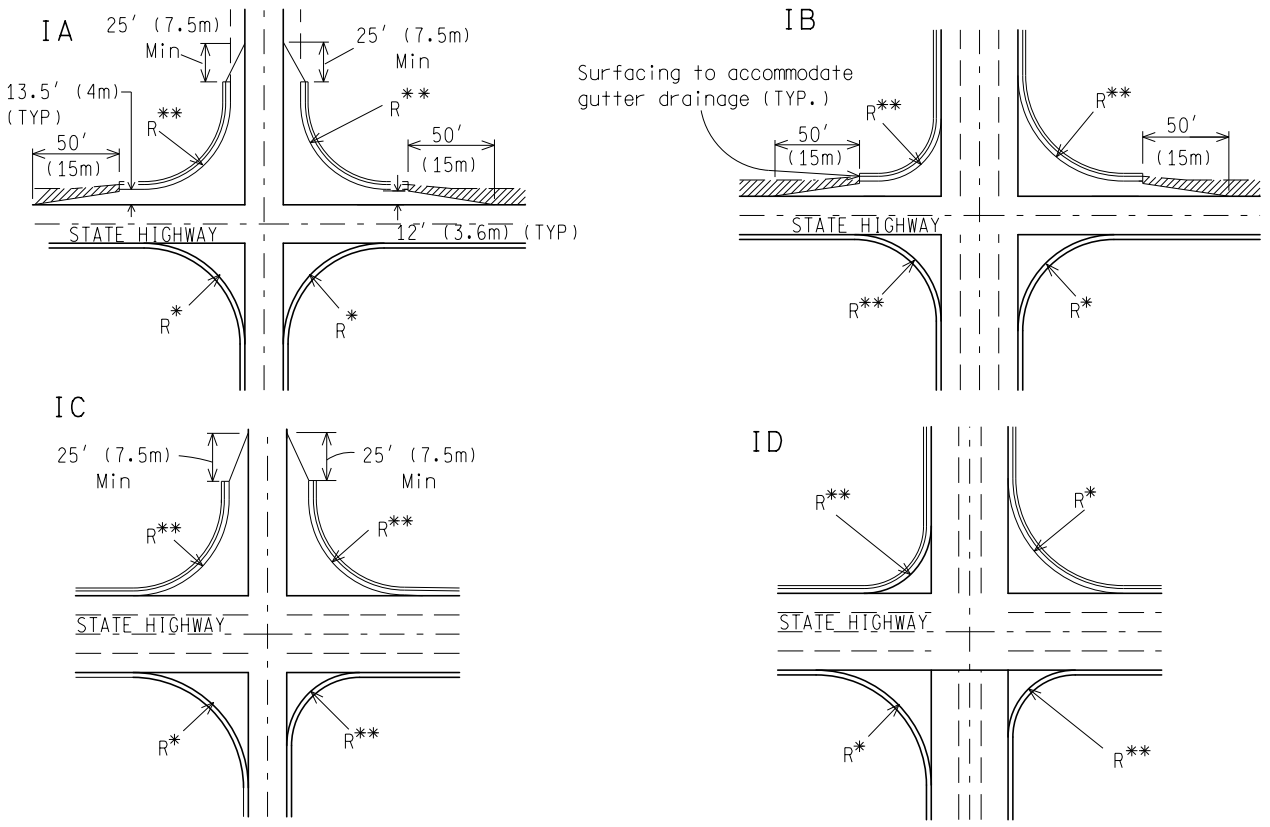
4. When a state highway intersects a one way approach, in non-turning quadrants the radius shall be a maximum of 10′ (3m).

5. On the National Truck Network and Green Route intersections where trucks turn, a WB-65 Interstate Semi-Trailer is the design vehicle.

6. For dual turns - consult the Geometric Review and Congestion Analysis Unit, Division of Operations.

NOT TO SCALE

INTERSECTION LAYOUTS



NOTES:

1. An intersecting road as herein defined may be a city street, county road or state highway.

2. 12' (3.6m) wide lanes are to be used unless conditions require narrower lanes.

3. On horizontal curves, the cross slope on turn lanes should be the same as the through pavement. Where physical constraints do not make this practical the maximum allowable algebraic difference in cross-slope between the turn lane and mainline is 5%, with a desirable maximum of 4%.

4. See Standard Plan R-30-Series for curb and gutter details.

5. Clear vision areas should be considered at all intersections.

6. Alternate Typical A may be used when construction and maintenance make the 13.5' (4.1m) curb setback undesirable or the crossroad is curbed.

7. Current AASHTO "A Policy on Geometric Design of Highways and Streets" and MDOT Guidelines should be used for sight distance requirements.

8. See Traffic & Safety Note 614A for guidance on nearside and farside lane drops at intersections.

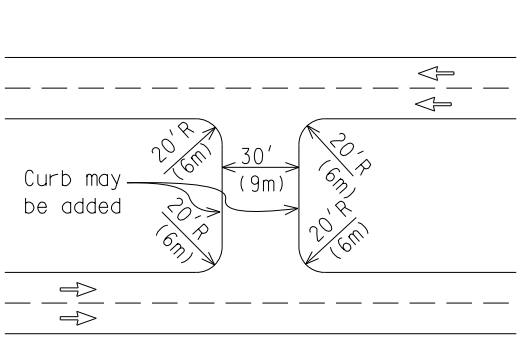
9. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Review and Congestion Analysis Unit, Division of Operations.

NOT TO SCALE

BI-DIRECTIONALS

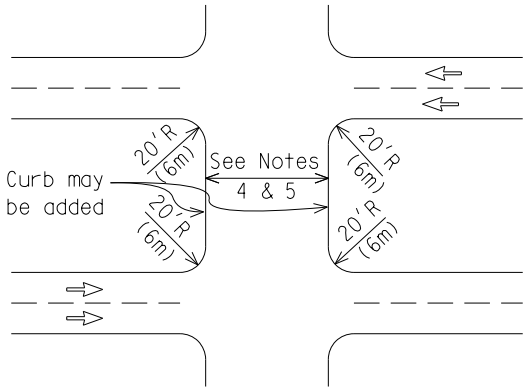
FREE-ACCESS

Dimensions may vary depending on design vehicle and turning movements. See GEO-650-Series for addtional details.



Radii shall form a semicircle for median widths of 40' (12m) or less. Also, see notes.

B-1



Radii shall form a semicircle for median widths of 40' (12m) or less. Also, see notes.

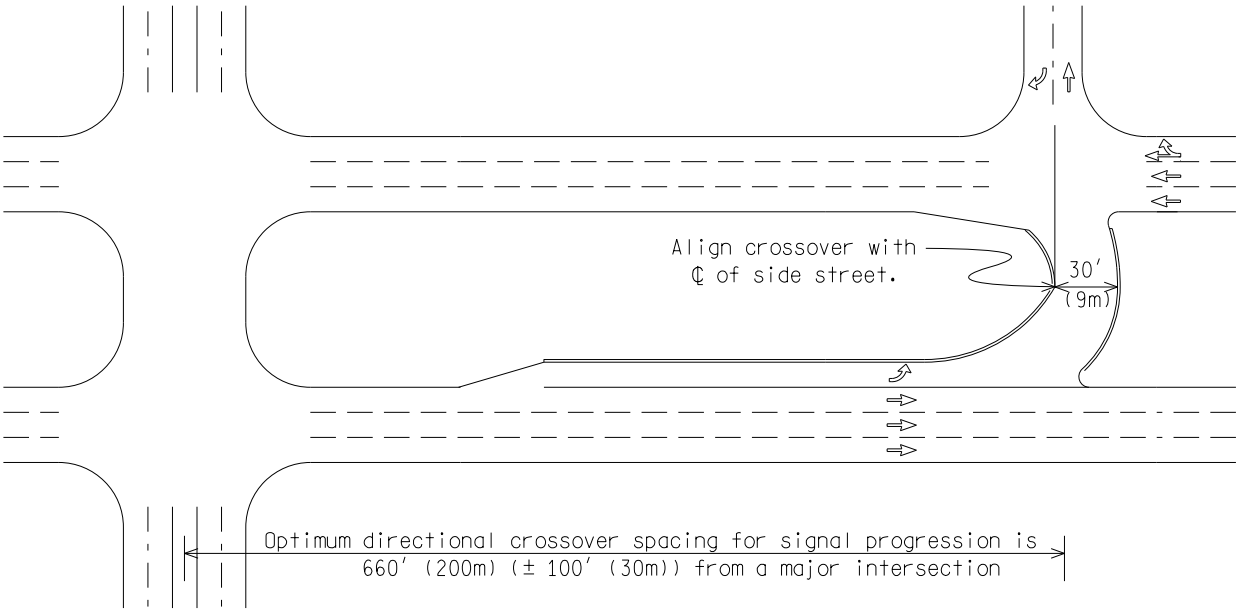
B-2

SPECIAL

Special situations, i.e., wide streets, one-way streets, or heavy left-turn movements may make other crossover widths desirable. Their details should be determined by the Geometric Review and Congestion Analysis Unit, Division of Operations. Also, see notes.

B-0

GENERAL PLACEMENT OF DIRECTIONAL CROSSOVERS



The number of crossovers per mile (km) is determined by need. Generally, 1/8 mile (0.2km) spacing is used in urban areas and 1/4 mile (0.4km) spacing is used in rural areas.

NOT TO SCALE

MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY

DRAWN BY: ECH
CHECKED BY: IRG
FILE:PW RD TS Geo/mdot traf GEO-670-E.dgn REV.

GEOMETRIC DESIGN GUIDE FOR

CROSSOVERS

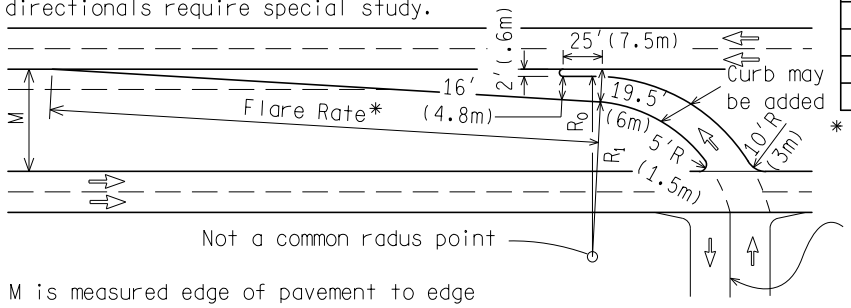
06/10/2014
PLAN DATE:

GEO-670-E

DIRECTIONALS

FREE-ACCESS

Cross-street directionals for median widths over 100′ (30m) and less than 26′ (8m) require special study. Rural cross-street directionals require special study.

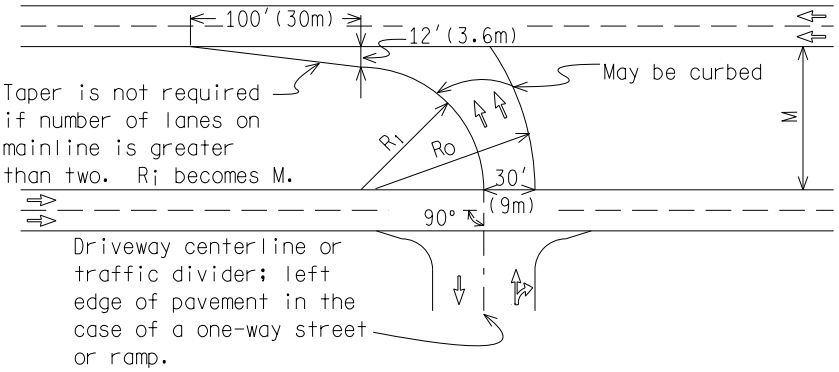


M is measured edge of pavement to edge of pavement.

DETAIL	MEDIAN WIDTH, M	R_1	R_O
D-11U	100′-66′(30m-20m)	(1.4)(M)	(1.6)(M)
D-12U	65′-41′(20m-12m)	(1.4)(M)	(1.8)(M)
D-13U	40′-26′(12m-8m)	(1.8)(M)	(2.0)(M)
D-10	SPECIAL		

* Use GEO-100-Series and GEO-101-Series for desirable flare rates.

D-10 THRU D-13U



DETAIL	MEDIAN WIDTH, M	R_1	R_O
D-21U	100′-30′(30m-9m)	M-12	(1.75)(M)
D-20	SPECIAL		

Median widths over 100′ (30m) and less than 30′ (9m) require special study.

D-20 AND D-21U

SPECIAL

Special situations may make other crossover details desirable. Their details should be determined by the Geometric Review and Congestion Analysis Unit.

Special study is required for directional crossovers with median widths less than 30′ (9m) or greater than 120′ (36m).

Loons may be required opposite crossover to accommodate turns in narrow medians.

D-0

AUXILIARY LANE TAPER TABLE

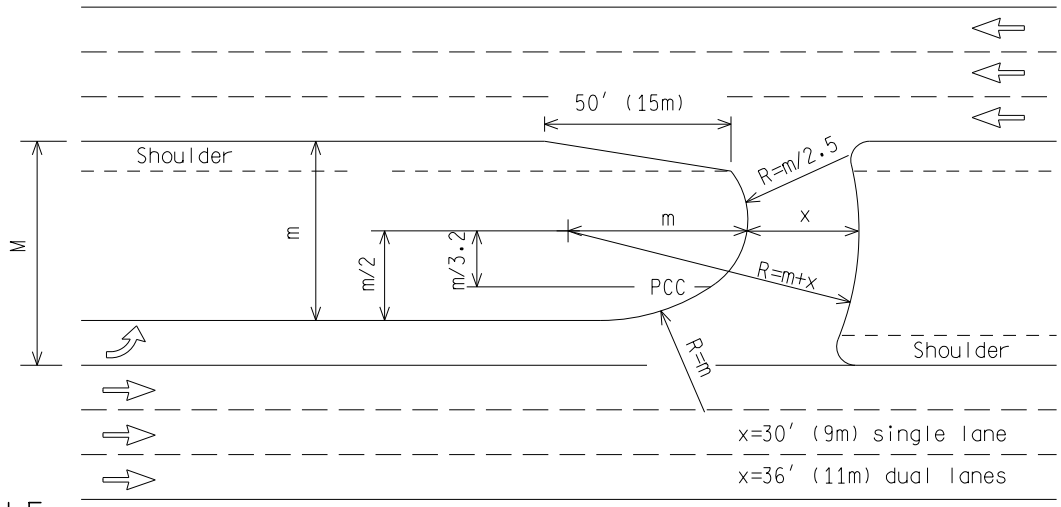
Not to be used for transitioning through traffic. The taper rate is the same for both curbed and uncurbed roadways.

POSTED SPEED MPH (kph)	AUXILIARY TAPER Ft (m)
≤ 35 (≤ 60)	75(23)
40 (60)	100(30)
45 (70)	130(40m)
50 (80)	180(55m)
55 (90)	225(70m)

T-1

CROSSOVER LAYOUT DETAIL

In an uncurbed area, use type "B" curb along storage lane and on both inside and outside radii.

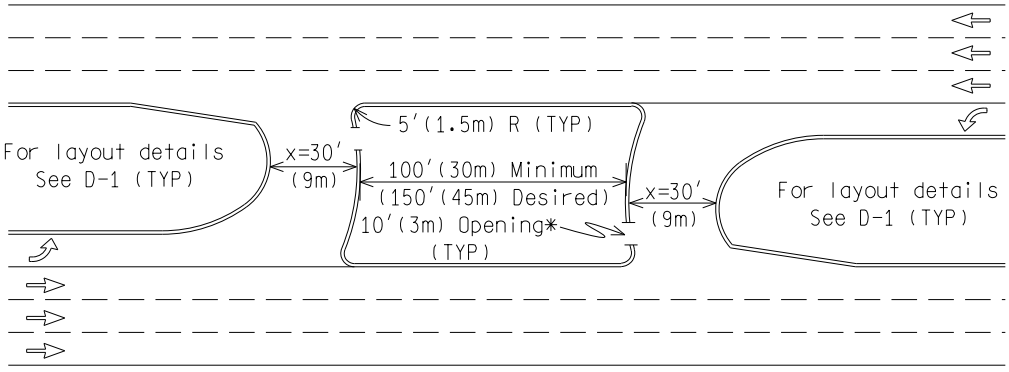


D-1

NOT TO SCALE

CURBED SECTION

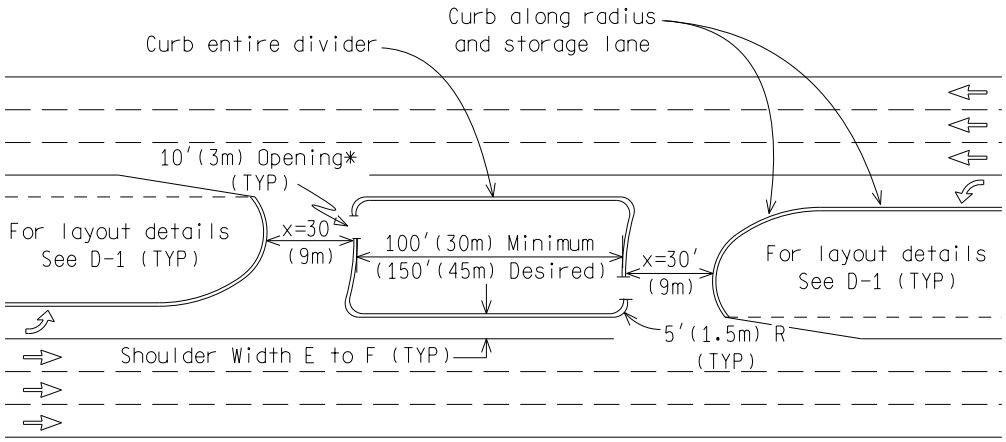
Crest of mound, for drainage and aesthetics, should not exceed 1' (0.3m) above the top of curb. If not paved, vegetation must not obstruct driver sight distance (TYP).



D-2

*See detail "L" on Standard Plan R-29-Series.

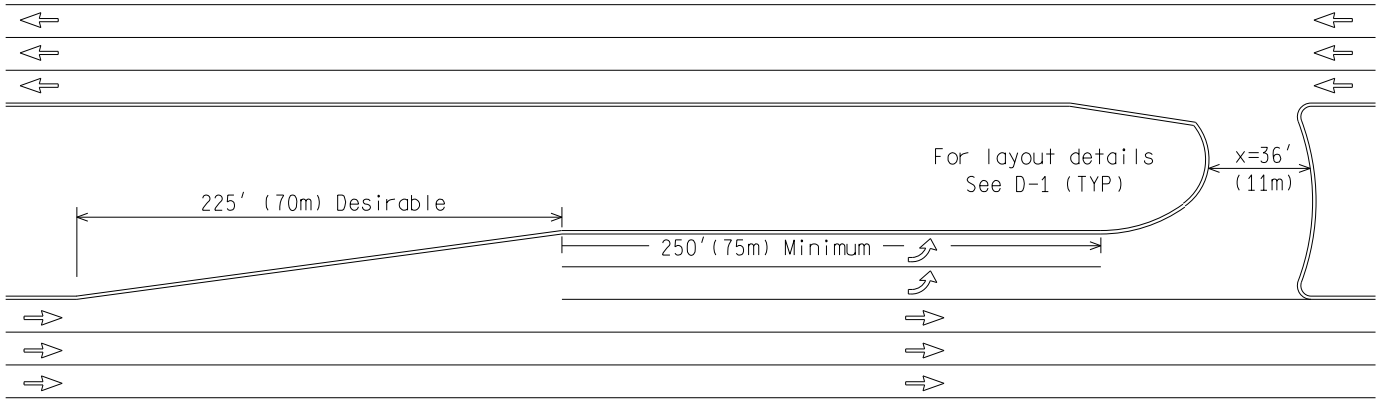
UNCURBED SECTION



D-3

*See detail "L" on Standard Plan R-29-Series.

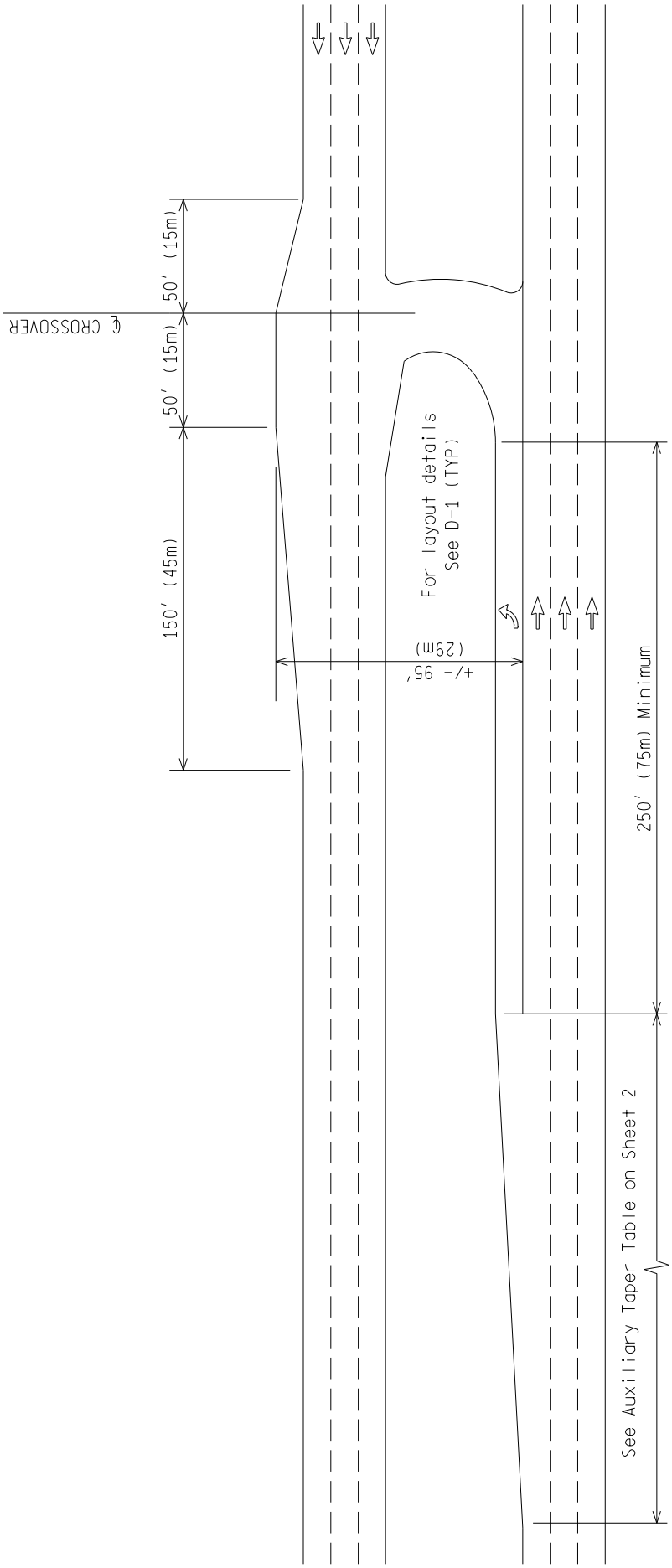
DUAL TURNS



D-4

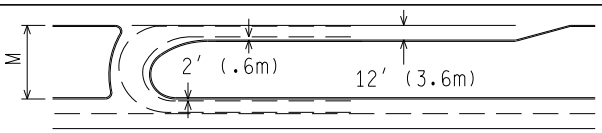
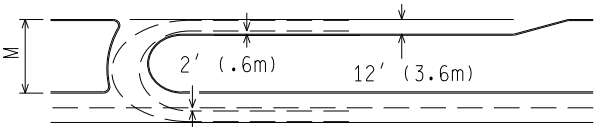
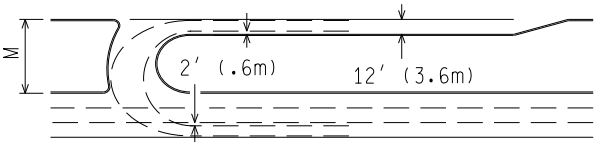
NOT TO SCALE

TRUCK LOON



NOT TO SCALE

MINIMUM DESIGNS FOR U-TURNS

Type of Maneuver	M = Min. width of median - ft (m) for design vehicle				
	P	SU	BUS	WB-50	WB-65
Left Lane to Inner Lane 	44′ (13.4m)	76′ (23.2m)	80′ (24m)	82′ (25m)	82′ (25m) *
Left Lane to 2nd Lane 	32′ (9.8m)	64′ (19.5m)	68′ (20.7m)	70′ (21m)	70′ (21m) *
Left Lane to 3rd Lane 	22′ (6.7m)	54′ (16.5m)	58′ (17.7m)	60′ (18m)	60′ (18m) *

* To accommodate WB-65 semi-trucks, provide 36′ (11m) crossover width or 4′ (1.2m) paved area behind curb on the inside radius, from spring point to spring point.

Vehicle Codes and Length of Design Vehicle - ft (m)

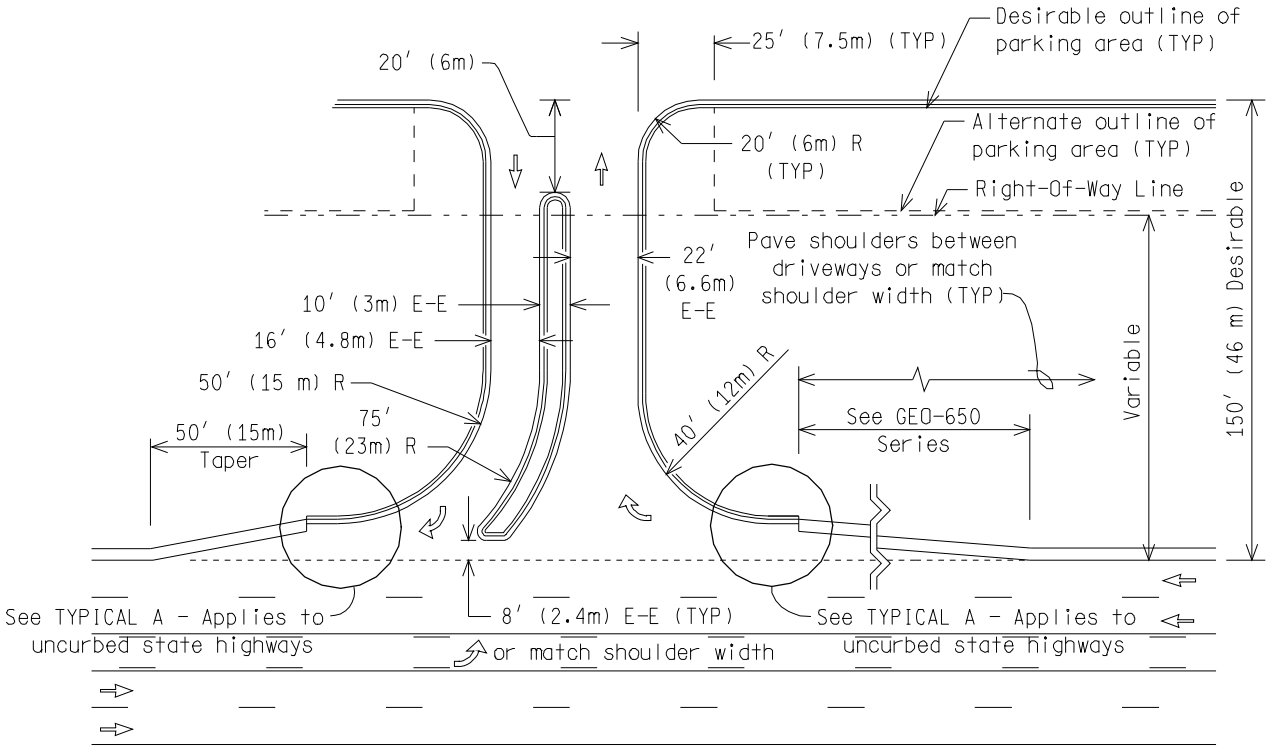
P = Passenger, 19′ (5.8m)
SU = Single Unit Truck, 30′ (9m)
BUS = Bus, 40′ (12m)
WB-50 = Semi-Truck Medium Size, 55′ (16.5m)
WB-65 = Semi-Truck Large Size, 70′ (21m)

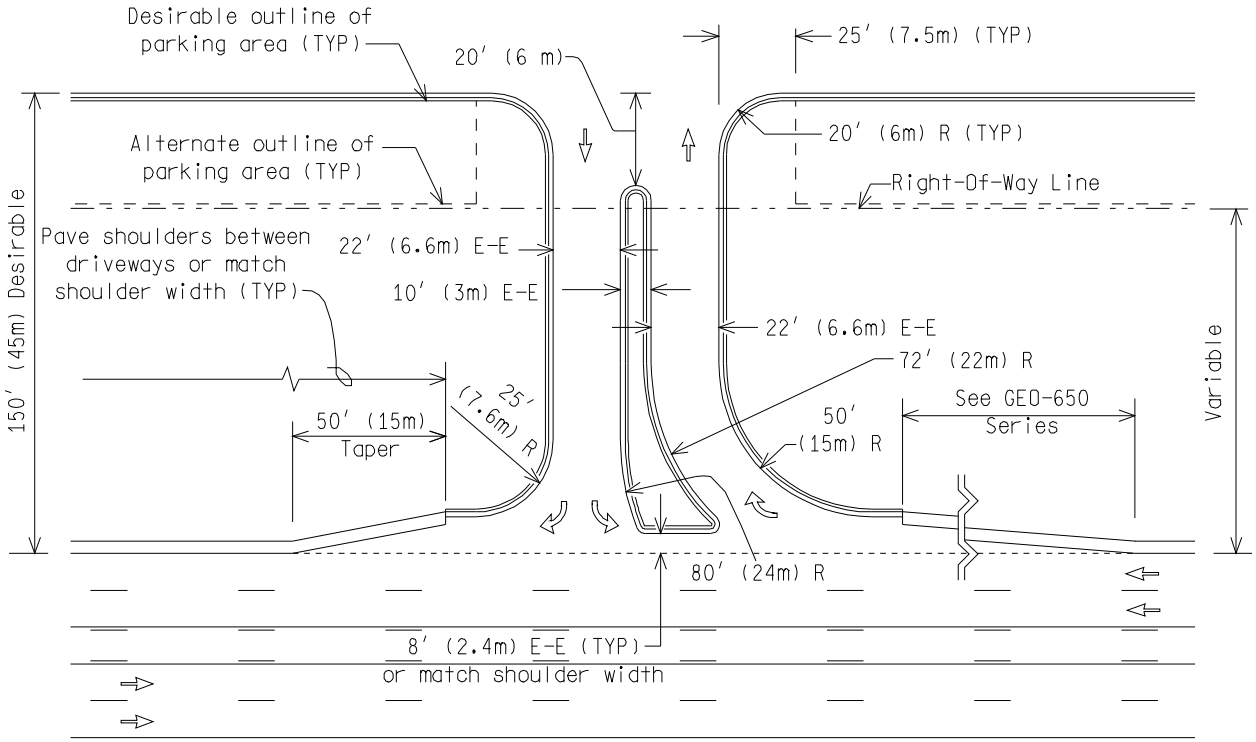
NOTES:

1. Crossovers should be called for by their respective detail number or detailed in the plans.
2. Crossover details are to be used on free-access facilities only.
3. Bi-directional crossovers should have a minimum width of 30′ (9m) at intersecting streets or commercial driveways which are 30′ (9m) or less in width. For intersecting streets or commercial driveways that have a width of greater than 30′ (9m), the width of the crossover should match the cross street width.
4. Desirably, free-access crossover grades should not exceed 3%; steeper grades require special study.
5. For type of curb on crossovers, see Sec. 6.06.06 of Road Design Manual.
6. For typical joint layouts on concrete pavement, see Standard Plan R-42-Series.
7. These design concepts are for new construction. Where modification may be needed for retrofitting to existing road features, consult the Geometric Review and Congestion Analysis Unit, Division of Operations.
8. Current AASHTO "A Policy on Geometric Design of Highways and Streets" and MDOT Guidelines should be used for sight distance requirements.

NOT TO SCALE

DIRECTIONAL DRIVEWAYS AT HIGHWAYS WITHOUT CURB

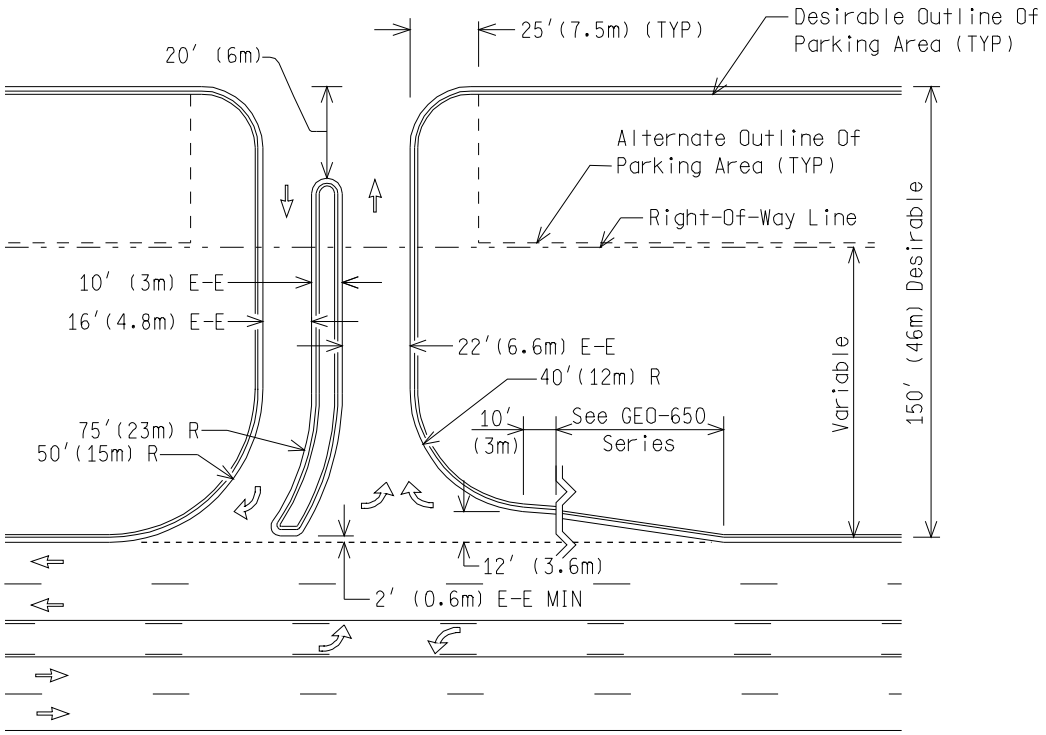


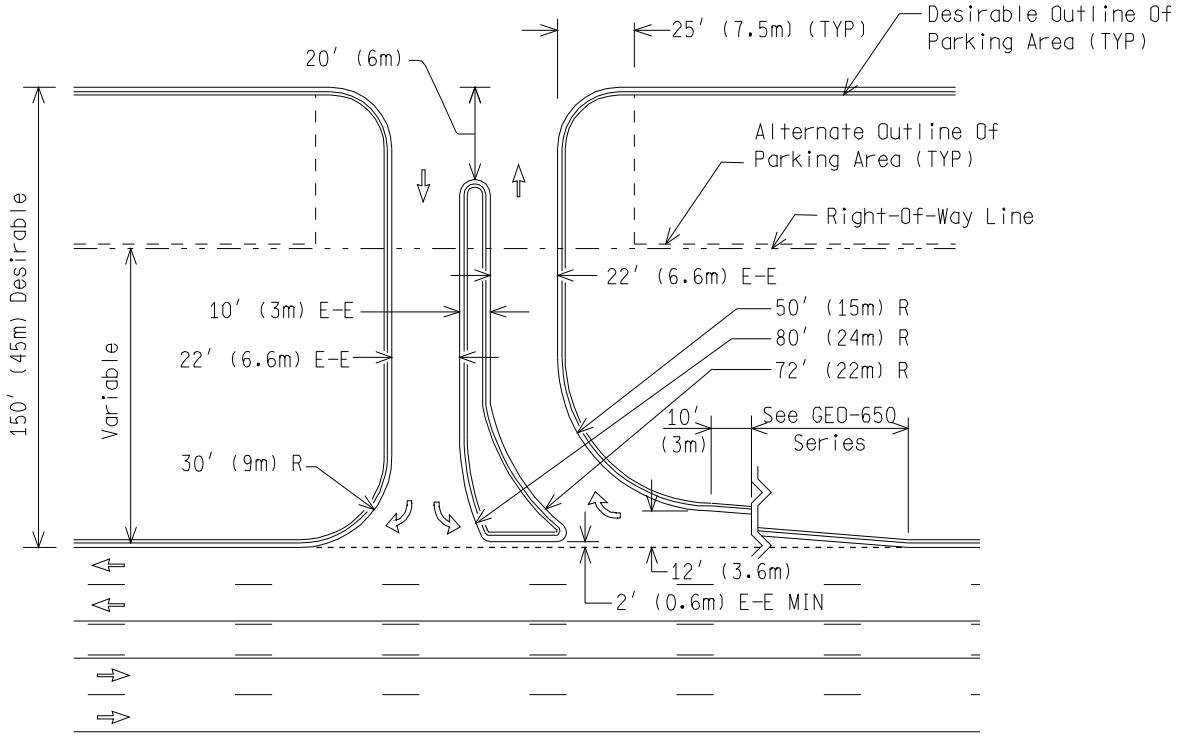


NOT TO SCALE

MDOT Michigan Department of Transportation TRAFFIC AND SAFETY	BY: John C Friend ENGINEER OF DELIVERY	GEOMETRIC DESIGN GUIDE FOR COMMERCIAL DRIVEWAYS	
DRAWN BY:	BY: Mark A Van Portfliet ENGINEER OF DEVELOPMENT		
CHECKED BY: IG/JAT		06/03/2010 PLAN DATE:	GEO-680-B
FILE:PW RD TS Geo/mdot traf GEO-680-B.dgn	REV. 01/20/2010		SHEET 1 OF 6

DIRECTIONAL DRIVEWAYS AT HIGHWAYS WITH CURB

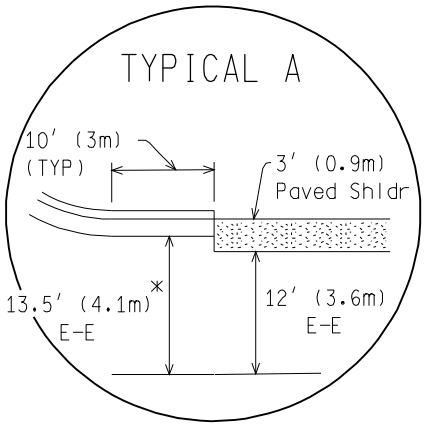


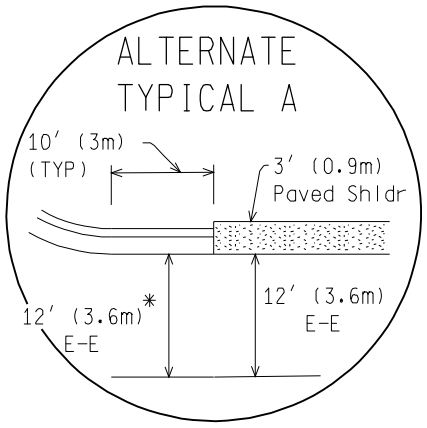


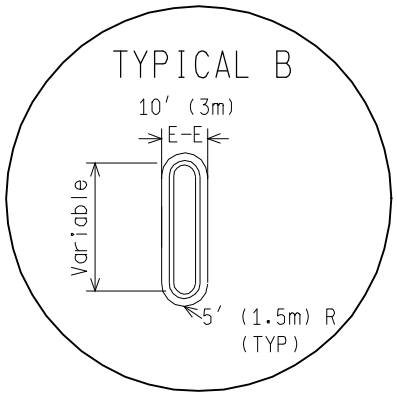
NOT TO SCALE

CURB RETURN OFFSET DETAILS

APPLIES TO UNCURBED STATE HIGHWAYS

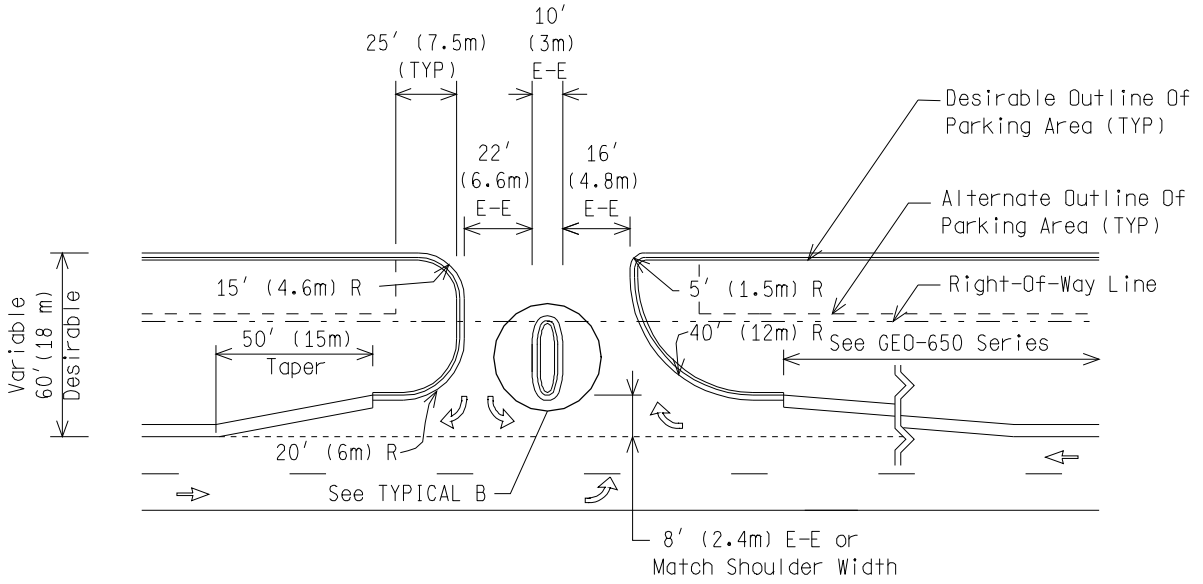




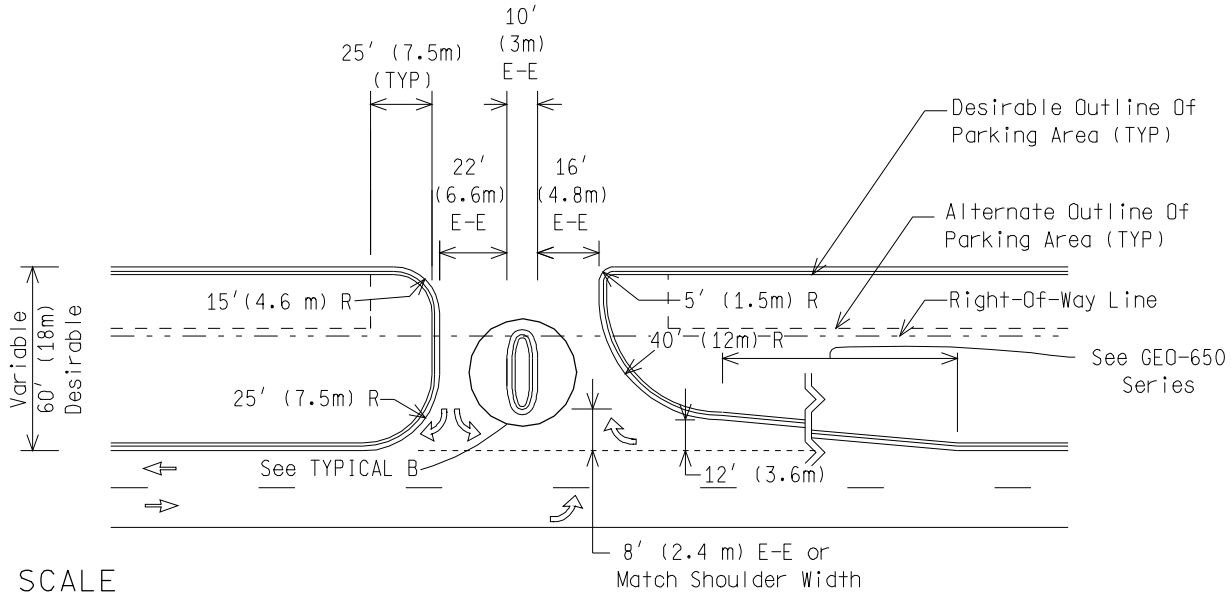


*See Note #9 on Sht #6

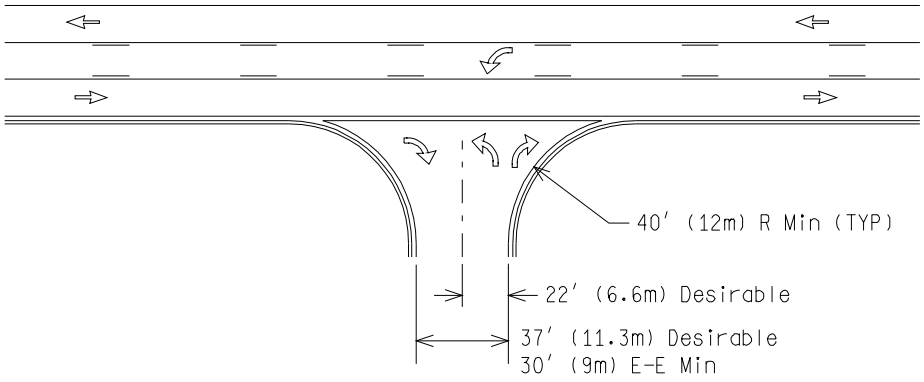
DIVIDED DRIVEWAYS ON HIGHWAY WITHOUT CURB



DIVIDED DRIVEWAYS ON HIGHWAY WITH CURB

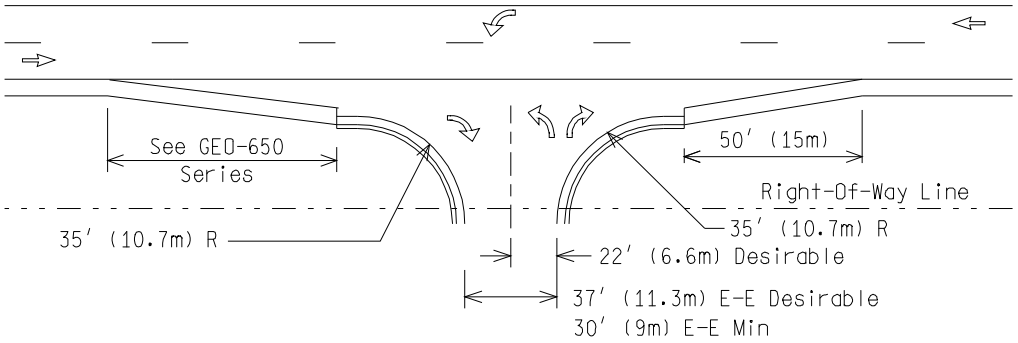


NOT TO SCALE

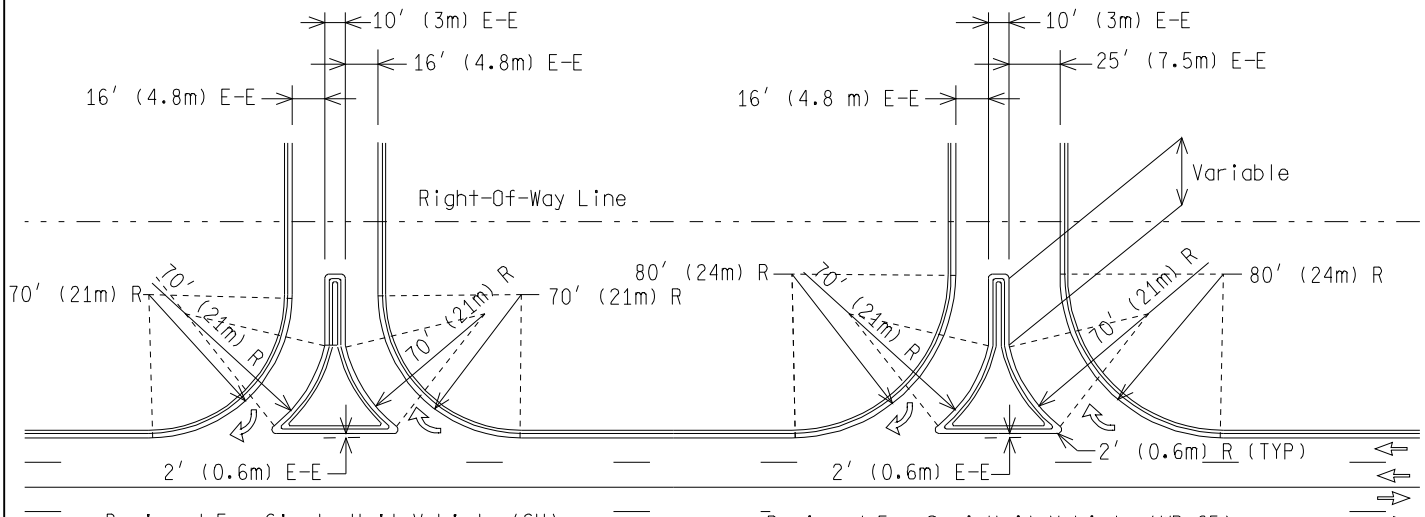


(For Three Lanes, Width Should Be 39′ (11.7m) Min)

TWO-WAY DRIVEWAYS ON HIGHWAYS WITH CURB



TWO-WAY DRIVEWAYS ON HIGHWAYS WITHOUT CURB

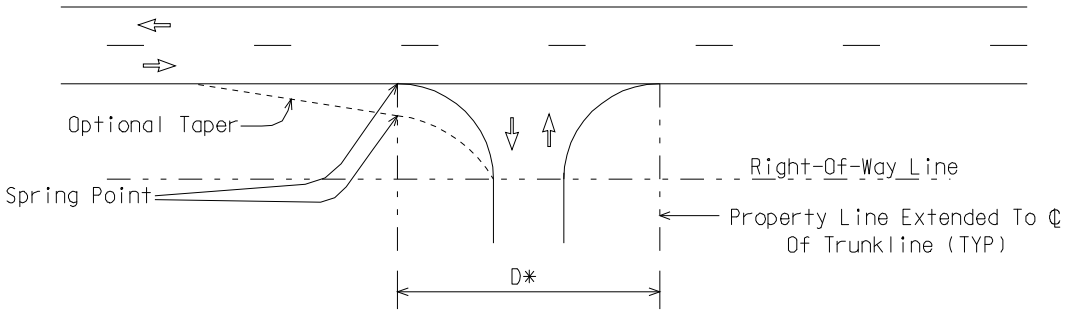


Designed For Single Unit Vehicle (SU) "Width And Radii Should Be Modified To Accommodate Larger Vehicles"

Designed For Semi Unit Vehicle (WB-65) "Width And Radii Should Be Modified To Accommodate Larger Vehicles"

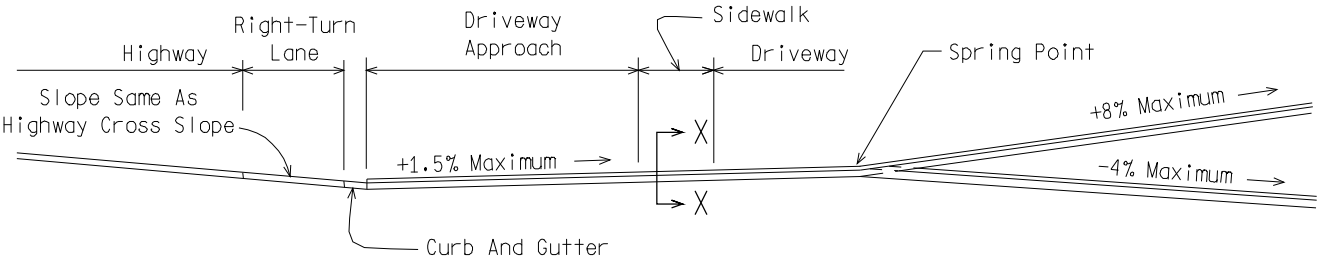
RIGHT-IN RIGHT-OUT DRIVEWAYS WITH CURB

NOT TO SCALE



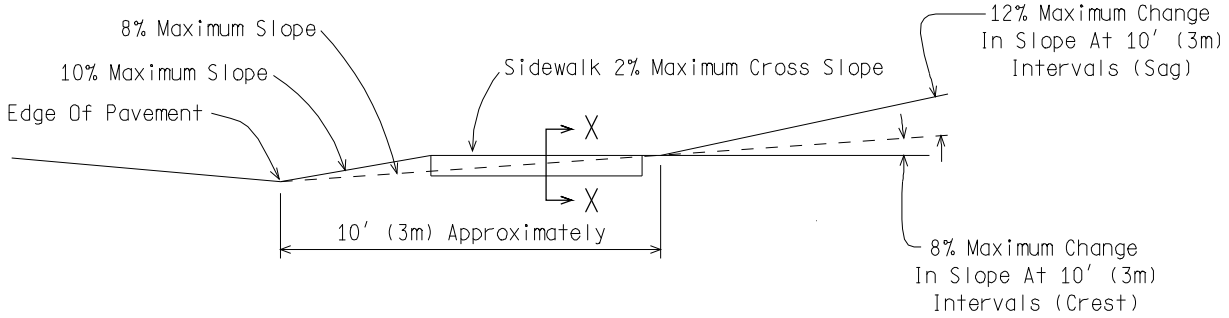
* Driveways For Each Property Including Radii, Must Be Located Within These Limits Unless Written Permission Of The Adjacent Property Owner Is Obtained

HIGHWAY FRONTAGE



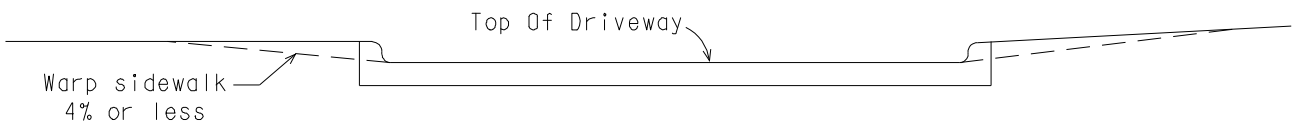
COMMERCIAL DRIVEWAY PROFILE FOR MAJOR TRAFFIC GENERATORS

Over (100) Peak Hour Directional Trips



When transverse slope is less than 1.5%, longitudinal drainage must be provided. See also R-29-Series.

LOW VOLUME COMMERCIAL OR RESIDENTIAL DRIVEWAY SLOPES



SECTION X-X

In urban areas the sidewalk shall be lowered at the edge of the driveway or lowered as shown in Section X-X whenever the maximum grades shown will be exceeded. See also R-28-Series when sidewalk ramps are required.

SIDEWALK LOWERING DETAIL

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NOTES:

1. The Region or TSC Traffic Engineer shall determine the necessary signing and pavement marking requirements to ensure that the driveway will operate safely and efficiently. The property owner shall erect and maintain all required signing and pavement markings as a condition of the driveway permit.

2. Consult the Region or TSC Traffic Engineer whenever:
   A. There is a question as to which type of driveway a commercial establishment should use.
   B. Operational conflicts with existing or anticipated future driveways across the highway may occur.

3. Suitable median crossovers may be required on divided highways as per Geometric Design Guide GEO-670-Series.

4. For dimensions not shown on this guide, refer to the document "Administrative Rules Regulating Driveways, Banners, and Parades On And Over Highways".

5. One-way driveways should be complemented with a well designed angle parking area to encourage one-way operation.

6. Driveway widths and radii shall be designed for the proper design vehicle. Where proper radii can not be provided, increase the drive throat width.

7. In urban areas a partial arc radius should be used when the distance from the edge of pavement to the sidewalks is between 5′ (1.5m) and 20′ (6m). When this distance is less than 5′ (1.5m), consult the Region or TSC Traffic and Safety Engineer to determine the width and radii of the driveway.

8. See MDOT Construction Permit Manual.

9. Alternate Typical A may be used when construction and maintenance issues make the 13.5′ (4.1m) curb setback undesirable.

10. For divided driveways, the desirable area of separating islands is 75ft^2 (7m^2), preferably 100ft^2 (9m^2). The island width shall not be less than 4′ (1.2m).

11. To eliminate left turns locking up from the cross street or driveways at unsignalized divided drives, the left turning vehicles should be headed up across from each other.

12. Current AASHTO "A Policy on Geometric Design of Highways and Streets" and MDOT Guidelines should be used for sight distance requirements.

13. These design concepts are for new construction. Where modifications may be needed for retrofitting to existing road features, consult the Geometric Review and Congestion Analysis Unit, Division of Operations.

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MDOT Michigan Department of Transportation

TRAFFIC AND SAFETY

DRAWN BY: ECH

CHECKED BY: IRG/JAT

FILE:PW RD TS Geo/mdot traf GEO-690-D.dgn

BY: John C. Friend
ENGINEER OF DELIVERY

BY: Mark A. VanPortfleet
ENGINEER OF DEVELOPMENT

REV. 03/10/2010

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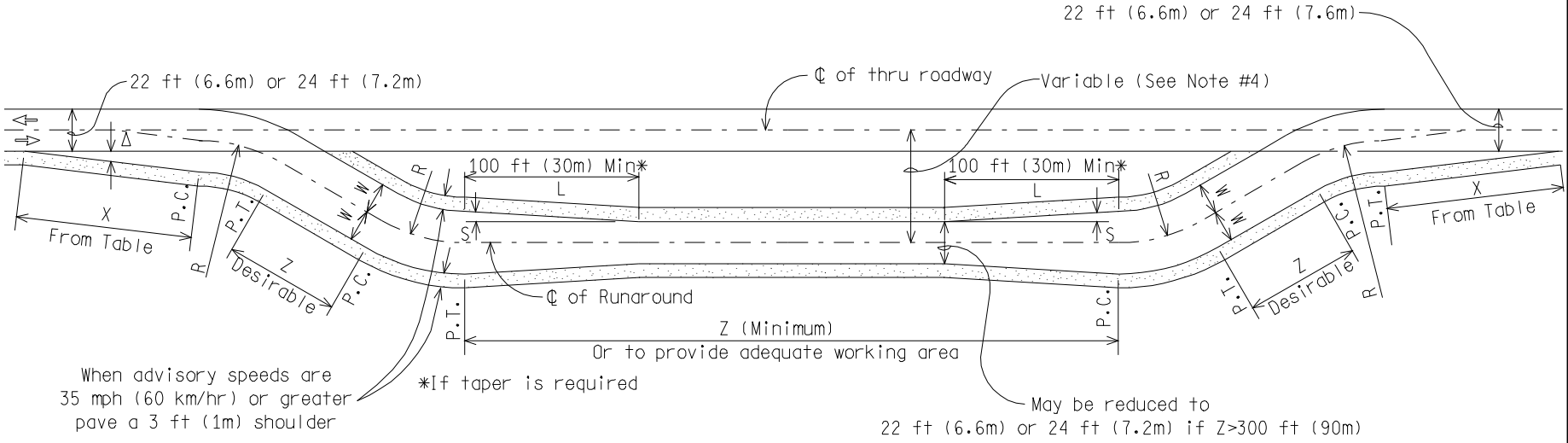
TEMPORARY RUNAROUND BASED ON A WB-65

TWO LANES, EITHER 2-WAY OR 1-WAY



THRU LANE SHIFT L (TYP)
For Speeds 45 mph (70 kph) or more:
L=WS (L=0.62WS)

For Speeds less than 45 mph (70 kph):

$L = \frac{WS^2}{60}$ $\left(L = \frac{WS^2}{155}\right)$

L= length in feet (meters)
S= speed in mph (kph)
W= offset in feet (meters)

DESIGN SPEED		LANE WIDTH		22 ft (6.6m) WIDTH			24 ft (7.2m) WIDTH			R		Z	
MPH	(km/h)	W(Ft)	W(m)	X(ft)	X(m)	Δ	X(ft)	X(m)	Δ	Ft	(m)	Ft	(m)
15	(20)	18	(5.5m)	100	(30m)	7°-58′	100	(30m)	6°-51′	95	(29m)	66	(20m)
20	(30)	16	(5m)	100	(30m)	5°-43′	100	(30m)	4°-34′	175	(53m)	88	(27m)
25	(40)	15	(4.5m)	100	(30m)	4°-34′	100	(30m)	3°-26′	280	(85m)	110	(34m)
30	(50)	15	(4.5m)	120	(40m)	3°-49′	100	(30m)	3°-26′	415	(127m)	132	(40m)
35	(60)	14	(4.3m)	125	(37m)	2°-45′	100	(30m)	2°-17′	585	(178m)	154	(47m)
40	(60)	14	(4.3m)	160	(48m)	2°-09′	105	(32m)	2°-11′	790	(241m)	176	(54m)
45	(70)	14	(4.3m)	270	(76m)	1°-16′	180	(55m)	1°-16′	1040	(317m)	198	(60m)

NOTE: Chart assumes no superelevation. For higher design speeds, superelevation may be required.

GEOMETRIC DESIGN GUIDE FOR

TEMPORARY RUNAROUND

06/03/2010
PLAN DATE:

GEO-690-D

SHEET 1 OF 2

NOTES:

1. The minimum design speed for runaround should be 10 mph (15kph) less than the posted speed prior to construction. A lower design speed may be necessary due to site conditions.

2. If a stop condition exists on the runaround, minimum design speed may be used.

3. Modifications to this layout are required for freeway traffic and/or design speeds greater than 45 mph (70kph).

4. The design and location of the runaround should be carefully reviewed to provide the contractor with an adequate working area.

5. When the temporary runaround is for a railroad crossing, it is recommended that 60′ (18m) be provided between the edge of runaround and the edge of crossing.

6. The geometrics shown do not include superelevation. A typical crown slope is used. If it is desired to include superelevation, contact the Region/TSC Traffic and Safety Engineer.

7. Locate the beginning of runaround to provide decision sight distance for an approaching motorist. Maintain stopping sight distance along the runaround.

8. Normally the runaround should be surfaced with concrete or HMA. An aggregate surface can only be used when none of the following conditions are exceeded.

   a. Traffic volume during construction - 3,000 ADT with less than 8% commercial vehicles or 5,000 ADT with less than 3% commercial vehicles.

   b. Physical conditions - grades of 6% and 300′ (90m) in length.

   c. Duration of time - one month.

   d. Speed - 30 mph (50kph)

   e. Commercial vehicle volume - 200 ADT.

   When an aggregate surface is used, a pay item should be included for grading, shaping, and adding material (and/or dust palliative), as requested by the engineer to maintain a reasonably smooth drivable surface.

9. Where advisory speeds are 35 mph (60kph) or greater, pave 3′ (1m) shoulder ribbons.

10. The placing of pavement markings, signs, guardrail, and movable barricades should be as directed by the Region/TSC Traffic and Safety Engineer. See the current Michigan Manual of Uniform Traffic Control Devices, Part VI, Construction and Maintenance and current MDOT guidelines.

11. Maximum desirable grade is 6%.

12. See Standard Plan R-113-Series for lane closures and crossovers.

13. See the section on temporary roads of the current Road Design Manual for more information.

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